News about

B. F. Goodrich Chemical *raw materials*

These 4 "Cold" Hycar Rubbers meet every tough-job need

THESE "cold" polymerized types of Hycar rubber have a host of applications, especially where toughest conditions must be met. Each offers specific advantages, that can help you improve or develop more saleable products. Check over each one, and write us for helpful, technical information on your specific requirements. Please write Dept. HB-1, B. F. Goodrich Chemical Company, Rose Building, Cleveland 15, Ohio. Cable address: Goodchemco. In Canada: Kitchener, Ontario.

Hycar 1041	***High acrylonitrile copolymer.*** Easy processing, excellent oil and solvent resistance. Used for oil well parts, fuel cell liners, fuel hose, rolls, lathe cut gaskets, packings, "O" rings, etc.
Hycar 1042	***Medium acrylonitrile copolymer.*** Easy processing, very good oil and solvent resistance, good water resistance, excellent solubility. Used for shoe soles, kitchen mats, printing rolls, "O" rings, gaskets, etc. GR-S and vinyl resin modifications, adhesives and cements.
Hycar 1043	***Medium low acrylonitrile copolymer.*** Easy processing, good oil and solvent resistance, very good low temperature properties. Used for gaskets, grommets, "O" rings, hose and other applications which require improved low temperature properties.
Hycar 1432	***Crumb form—Medium acrylonitrile copolymer.*** Directly soluble—no milling required. Used for cements and adhesives.

B. F. Goodrich Chemical Company
A Division of The B. F. Goodrich Company

Hycar
Reg. U.S. Pat. Off.
American Rubber

GEON polyvinyl materials • HYCAR American rubber • GOOD-RITE chemicals and plasticizers • HARMON colors

For Tires, or Belts, or Rubber Shoes There's a PHILBLACK* you should use!

Each PHILBLACK is a specialist in a particular field.

For better extruded or molded products, use PHILBLACK A. This easy-mixing FEF (Fast Extrusion Furnace) black makes processing easy. You get smooth, fast tubings and excellent physical characteristics. Molds come out true to the die, with fewer rejects.

For improved abrasion resistance and long flex life, try PHILBLACK O, the HAF (High Abrasion Furnace) black that is the choice of manufacturers who stress quality and service. PHILBLACK O is a general industry favorite.

For extra long wear at moderate cost, use PHILBLACK I, the popular new ISAF (Intermediate Super Abrasion Furnace) black which is rapidly gaining favor with makers of premium cold rubber passenger tires. PHILBLACK I may be substituted part for part for HAF blacks.

For *super* durability use PHILBLACK E. This SAF (Super Abrasion Furnace) black is the toughest black on the market. PHILBLACK E is ideal for applications where extreme abrasion resistance and ability to withstand aging, cracking, cutting and chipping are of major importance.

For full information consult our technical sales representative or write our nearest office.

PHILLIPS CHEMICAL COMPANY

PHILBLACK SALES DIVISION

318 WATER STREET • AKRON 8, OHIO

PHILBLACK EXPORT SALES DIVISION • 80 BROADWAY • NEW YORK 5, N. Y.

* A Trademark

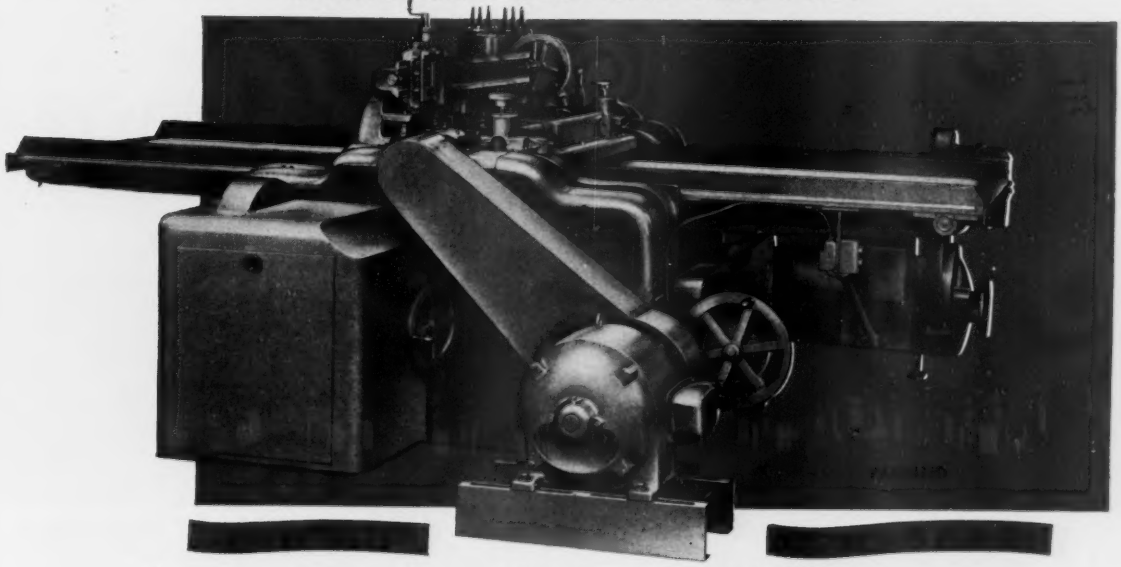
The Philblacks are manufactured at Borger, Texas. Warehouses in Akron, Boston, Chicago, and Trenton. West Coast agent: Harwick Standard Chemical Company, Los Angeles. Canadian agent: H. L. Blachford, Ltd., Montreal and Toronto.

Announcing

The MICRO-SURFACER

with CARBOLOY KNIFE CUTTERHEAD

A Sensational® ADVANCE IN PRECISION SIZING OF MOLDED RUBBER FLOORING, SOLING AND ASSOCIATED PRODUCTS!



1. Insures uniformity with precision accuracy — .001" tolerance.
2. Eliminates dirt and grit.
3. Provides excellent gluing surface.
4. Greatly increases production.
5. Reduces maintenance time.
6. Production is continuous.
7. Capacity: up to 50" widths.
8. Handles thin as well as thick stock.
9. 15,000 sheets between knife grinds.
10. Removed material is salvageable.

1. Carboloy knives.
2. Cutterhead speeds up to 5,000 RPM.
3. Variable feed.
4. Built-in grinding unit for knives.
5. Hard Chrome wearing surfaces.
6. Conveyors can be built into machine.
7. Adjustments graduated in thousandths.
8. Finger tip control.
9. Great flexibility of operation.
10. Rubber and chrome feed rolls gear-driven for positive feed.

[redacted] conveyors feed stock to the four feed rolls, the upper two of which are rubber, and the lower two, steel chrome plated. Molded sheets are thus brought under a high-speed rotating cutterhead having carboloy knives. Thin stock is held firmly during the cutting operation by a patented work platen. Tolerances of .001 are easily held.

[redacted] by more than two years of continuous production on rubber flooring molded sheets, prior to being offered to the trade, the MICRO-SURFACER is entirely perfected . . . a machine that will give you a better product, increase production and save its cost in short order. Write or call us for specifications and further information.

BUSS
ESTABLISHED 1862

Manufacturers of High Spindle Speed Machinery

BUSS MACHINE WORKS

25% FASTER CALENDERING

of heavy vinyl sheeting with PLIOVIC

So reads the report on Textileather Corporation, manufacturers of Tolex a new "plastic leathercloth" especially designed for use in coats, jackets and sportswear—and of other high quality, fabric-backed, heavy-gauge vinyl sheeting.

Using PLIOVIC – Goodyear's easier processing polyvinyl chloride resin – Textileather found they could operate their calenders at speeds up to 25% higher than those possible with any other resin tried. And they had no problem with the streaking, roughening or loss of gloss usually encountered in the finished sheet at such speeds.

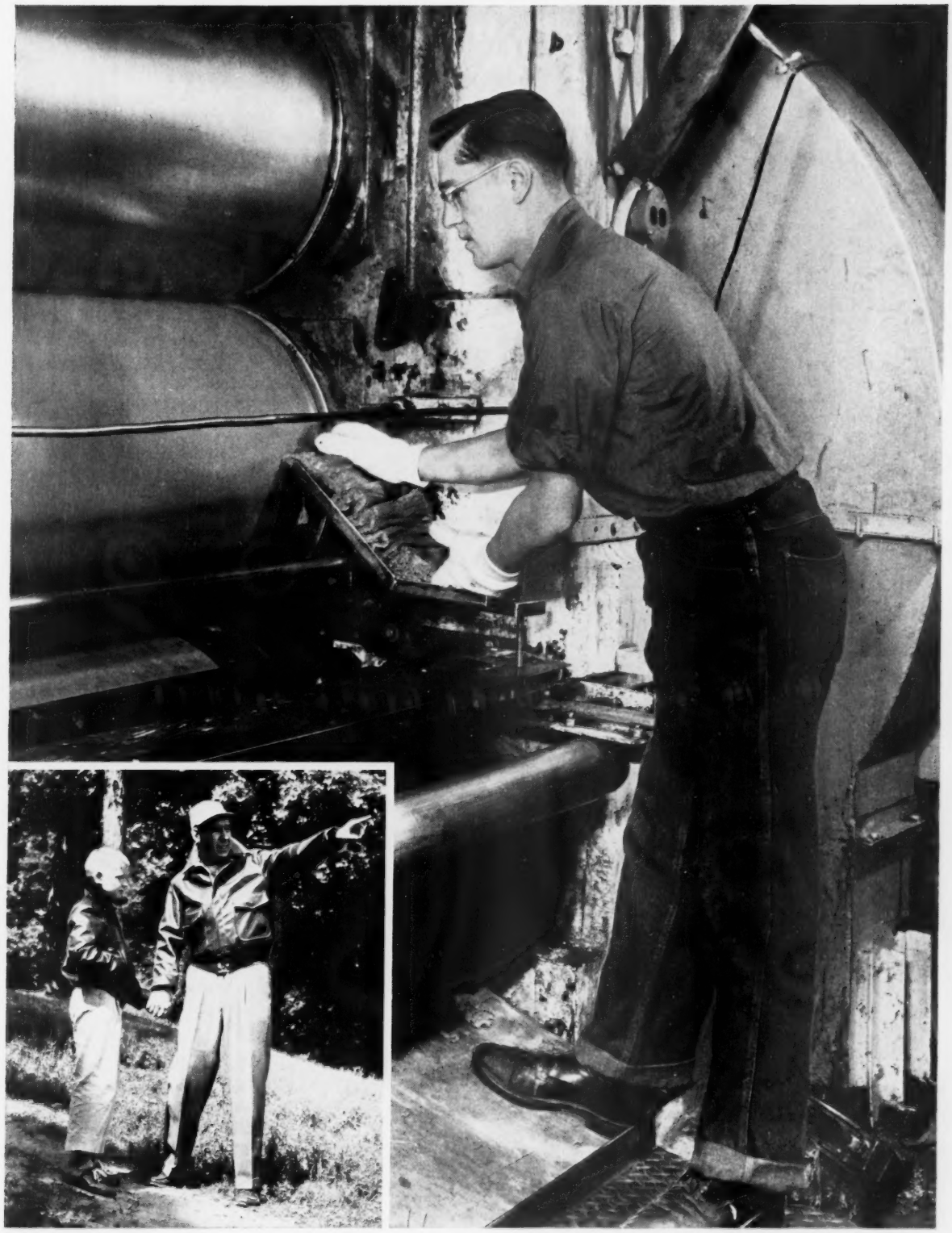
Two other advantages gained with PLIOVIC were the elimination of "fish-eyes"—hard agglomerates of unfused particles—in the sheet and the use of larger batches in the Banbury. All these added up to more throughput at lower cost, but at the same high level of quality.

Reason for this improved production with PLIOVIC is the fact that its polymerization is carefully controlled to give a particle size, shape and distribution, providing high bulk density and fast fluxing, combined with maximum physical properties.

PLIOVIC has proved itself in many plants. It can in yours. Just give it the chance. Get samples, the new technical manual and complete help, by writing to: Goodyear, Chemical Division, Akron 16, Ohio.

CHEMICAL GOODYEAR DIVISION

Use-Proved Products—CHEMIGUM • PLIOBOND • PLIOLITE • PLIO-TUF • PLIOVIC • WING-CHEMICALS—The Finest Chemicals for Industry



TOLEX MAKES these jackets soft, pliable, waterproof and highly resistant to scuffing or abrasion. PLIOVIC permits this fabric-reinforced sheeting to be calendered faster and at lower cost.

Tolex T. M. Textileather Corporation, Toledo, Ohio

We think you'll like "THE GREATEST STORY EVER TOLD"—every Sunday—ABC Radio Network—THE GOODYEAR TELEVISION PLAYHOUSE—every other Sunday—NBC TV Network

Chemigum, Pliobond, Pliolite, Plio-Tuf, Pliovic—T. M.'s The Goodyear Tire & Rubber Company, Akron, Ohio

R.D. Wood Hydraulic Presses

"... that industrial equipment which has maintained high excellence in manufacture will continue to be sold, and will contribute its worth to uplifting the general quality of everything produced in industrial America ..."

870-ton capacity multiple-opening hydraulic press designed for processing rubber and plastic sheets.
Write for catalogs of our hydraulic presses.

150th anniversary

WOOD

R. D. WOOD COMPANY

PUBLIC LEDGER BUILDING, PHILADELPHIA 5, PA.

HYDRAULIC PRESSES AND VALVES FOR EVERY PURPOSE • ACCUMULATORS • ALLEVIATORS • INTENSIFIERS

RUBBER FABRICATORS NEED ACCURATE CUTTING DIES

For Cutting

Rubber, Neoprene, Plastics, etc.
Sheeting, Foam, Sponge, Cellular,
Cured & Uncured

Gang Dies Our Specialty

- **Accuracy to close Tolerances**
- **Durability**
- **Genuine Understanding of the problems of rubber goods manufacturers**

MALLET HANDLE DIES

PURPOSE — For those who have no machinery and do not wish to purchase any. For Cutting — Rubber, Neoprene, Plastics, etc.

ADVANTAGE — Cut direct from bolts or not.

SERVICE—One to three days.

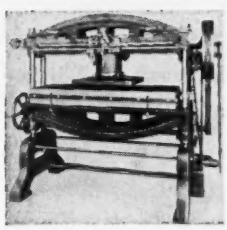
STEEL RULE CUTTING DIES

Used on Die Cutting Press, Printing Press or Power Press

PURPOSE — Especially suited for cutting — Rubber, Neoprene, Plastics, etc.

ADVANTAGE—Low in cost. Suitable for long production runs. It is necessary to cut from rectangular sheets which are fed into the press.

SERVICE—One day service.



STEEL RULE CLICKER DIES

Use On Clicker Machine or Dinker Press

PURPOSE—For Cutting Rubber, Neoprene, Plastics, etc.

ADVANTAGE — More reasonably priced than the all steel dies. Recommended for small and medium quantities where cost of an all steel die is not warranted.

SERVICE—One day service.

ALL STEEL DIES

Use On Clicker Machine or Beam Press or Power Press

PURPOSE—For Cutting—Rubber, Neoprene, Plastics, etc.

ADVANTAGE — Cut direct from rolls without first cutting into sheets.

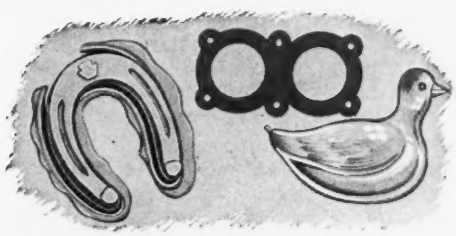
SERVICE—One to three day service on dies.

DIE CUTTING SERVICE

PURPOSE—For those who prefer to have their cutting done by others.

ADVANTAGE—We can die cut your product for you on our own presses rapidly and economically at a low "per thousand" cost.

SERVICE—One to three days.



Dies for cutting
Gaskets, flashing from molded parts, rubber soles, foam and sponge for furniture padding, inflated toys, clothing and footwear, etc.

SAME DAY SERVICE

ACCURATE

STEEL RULE DIE MANUFACTURERS

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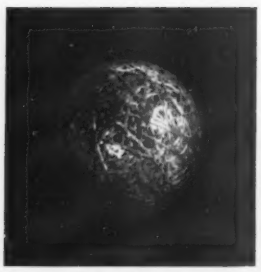
Subsidiaries: American Fabricators; Interstate Die Cutting Co., Inc.

Intelligent Service to the Rubber Goods Industry for Over 23 Years

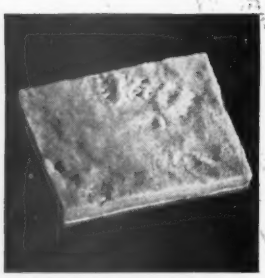
Top visibility... because of TITANOX® white pigment

On green or fairway, this glistening white ball is always visible. That's because it's pigmented from the inside out with TITANOX white titanium pigments.

Consultation with our Technical Service Department is available to firms desiring assistance on rubber and plastic pigmentation problems. Titanium Pigment Corporation, 111 Broadway, New York 6, N. Y.; Atlanta 2; Boston 6; Chicago 3; Cleveland 15; Los Angeles 22; Philadelphia 3; Pittsburgh 12; Portland 9, Ore.; San Francisco 7. In Canada: Canadian Titanium Pigments Limited, Montreal 2; Toronto 1.

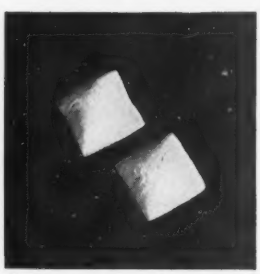


1. The liquid-filled rubber center is tightly wound with hundreds of feet of rubber thread.



2. Balata, the raw material for the cover stock, is a neutral grey before pigmentation.

These steps show how visibility is built into a modern golf ball. Courtesy of the Acushnet Process Company, New Bedford, Mass.



3. These cover stock blanks are pigmented with TITANOX before molding into cups that form the cover.

4. The completed ball is trimmed and then a Titanox-pigmented coating is applied.

® TITANOX

the brightest name in pigments

1815

TITANIUM PIGMENT CORPORATION

Subsidiary of NATIONAL LEAD COMPANY

NEW LOOK in nitrile rubbers is the lighter color and lighter weight bale of CHEMIGUM—first, and now, finest in the field.

NEWS IN NITRILES—

the light color, light bale of CHEMIGUM

NEWEST development in nitrile rubbers is the introduction of CHEMIGUM N-6 and CHEMIGUM N-7. Although markedly different in appearance, these two new, oil-resistant rubbers are basically the same as their respective predecessors–CHEMIGUM "30" N4NS and CHEMIGUM "50" N4NS.

After-reaction changes make it possible to give you the fundamental processing and property advantages of use-proved CHEMIGUM in a much lighter–almost white–color and a much lighter–50-pound–bale. The new color offers new possibilities in compounding. The new bale means easier handling.

With these new features, CHEMIGUM now offers you everything desired in a nitrile rubber–service, uniformity, ease of compounding, ease of handling, ease of processing and excellent physical properties. But the quickest way to be convinced is with a sample in your laboratory. You can get it, plus full technical help, simply by writing to:

Goodyear, Chemical Division, Akron 16, Ohio

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Chemigum, Pliobond, Pliolite, Plio-Tuf, Pliovic–T. M.'s The Goodyear Tire & Rubber Company, Akron, Ohio

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Second Edition of

LATEX IN INDUSTRY

By ROYCE J. NOBLE, Ph. D., F. I. R. I.

The first edition of this valuable book was published in 1936 and has been out of print for many years. Accordingly, the publication of a completely revised and enlarged edition is welcome news to the thousands of users of rubber latex who have been seeking an up-to-the-minute text book.

The author has kept posted on every phase of the latex industry since the first edition and has incorporated in the new edition complete details on all current uses of this versatile material. The book is replete with illustrations, charts, formulas and full descriptions of the various processes in use today.

920 Pages • 6 x 9 Inches • 25 Chapters

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WANT TO CUT RUBBER
and Costs
INSTALL THE NEW
"POWERMAX"
GUILLOTINE CUTTER
Send for our new Bulletin "W" today. It contains basic facts and information describing the Guillotine cutter and many other types of Akron Standard Equipment.

GUILLOTINE cutter machines are used for cutting either cured or uncured rubber or like materials to specific lengths. Clicking machines are used to cut the same materials to shape by means of a clicker type die. "Powermax" cutters perform speedy automotive cutting to very close tolerances with either manual loading or directly coupled to calender, mill or tubing machines. Controlled conveyor belt movement insures an accurate cut each time. Both speed and length of cut can be adjusted while machine is in operation. Knife cutting machines are equipped with an overhead driven roll preventing slippage on the conveyor belt of rubber or other material being cut. This roll may be raised when not needed. Maximum thickness of cut is 3″ on the standard machine, maximum speed 90 cuts per minute and cutting lengths can be varied from 0″ to 30″.

akron standard mold company

AKRON 8, THE ESTABLISHED MEASURE OF VALUE **OHIO**

PROBLEM: In order to continue offering their world-famous shoe values, Endicott Johnson must control both quality and costs of their rubber heels and soles as strictly as every other part of their shoes.

34 BALDWIN presses help Endicott Johnson keep quality high, costs low

SOLUTION: Accounting for their Rubber Division's entire output of heels and soles, 34 Baldwin presses help Endicott Johnson solve their perpetual problem of how to keep giving millions of Americans in small towns and rural areas shoes so good at prices so very low.

Baldwin hydraulic steam platen presses benefit them in these two ways:

1. *Quality*—Ease and simplicity of operation and accurate control over applied pressure ensure minimum variation in quality.

2. *Savings*—For over 30 years Endicott Johnson's Baldwin presses (increasing in number steadily since 1922) have proved they are easy to maintain and seldom require any replacement parts. Their high rate of production (nearly 5000 soles per press a day and approximately 38,000 heels per press a day) with a minimum amount of rejects also cuts costs.

One of two types of heel presses in use . . . single 16″ dia. ram, 4 openings, 16″ stroke, 251 tons, 2500 psi working pressure. Other type . . . two rams, 500 ton capacity.

Pressing soles with a single 22″ dia. ram, 475 ton, 4 opening press . . . 34″ x 40″ platen, 16″ stroke, 2500 psi pressure.

what's your pressing problem?

You, too, can improve quality and lower costs by calling your Baldwin press engineer for help in solving your pressing problem. Or write for Bulletin 290, to Dept. 3941, Baldwin-Lima-Hamilton Corp., Philadelphia 42, Pa.

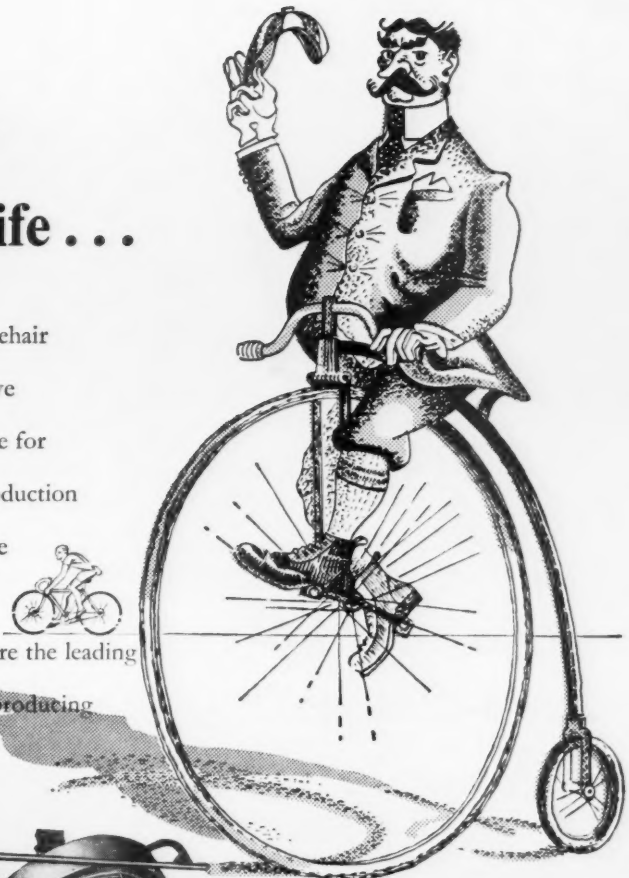
BALDWIN BLH LIMA-HAMILTON

BALDWIN-LIMA-HAMILTON

General Offices: Philadelphia 42, Pa. • Offices in Principal Cities

Grandfather had a hard life . . .

Cycle tyres stuffed with horsehair and cobbled streets must have made life a bit uncomfortable for Grandfather. Since the introduction of pneumatic tyres, we have kept full abreast of every development and today we are the leading manufacturers of cycle tyre producing equipment in the World.



SHAW

machinery for tyre and tube production

Shaw-McNeil 40-34-3¾ Twin Bag-o-matic Curing Press for Cycle Tyres. Supplied complete with motor and controller, time cycle controller—ready for connection to service lines.

FRANCIS SHAW AND COMPANY LIMITED MANCHESTER 11 ENGLAND
TELEPHONE: EAST 1415/8 TELEGRAMS: CALENDER, MANCHESTER
LONDON OFFICE: 34 VICTORIA STREET LONDON SW1 PHONE: ABBEY 1800 GRAMS: VIBRATE PHONE LONDON

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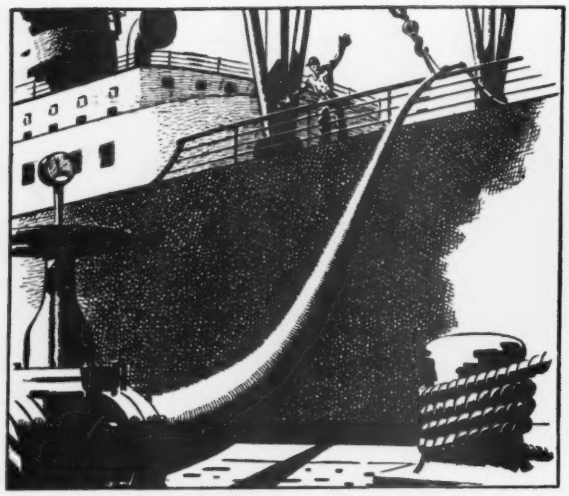
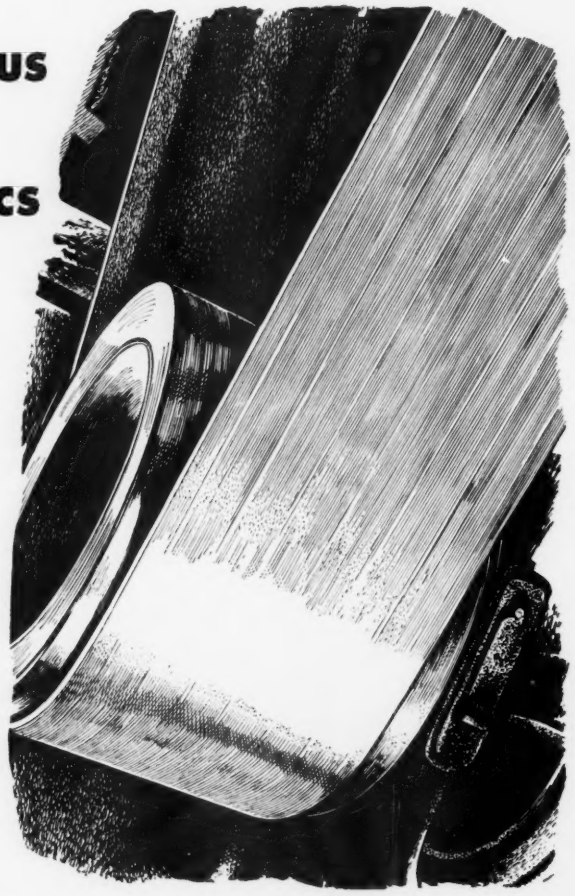
Enquiries to Francis Shaw (Canada) Limited, Grahams Lane, Burlington, Ontario, CANADA



"Shawmut" hose duck is a soft, strong, plied-yarn fabric affording flexibility and good impregnation in a variety of hose applications.

"Columbus" sheeting is ideally suited for service rainwear and other rubberized products because of its constantly uniform quality.

YOU GET PERFORMANCE-PLUS WITH WELLINGTON SEARS "FIBER-ENGINEERED" FABRICS



In developing high-performance belt fabrics for the rubber industry, Wellington Sears engineers draw upon the special advantages of many textile fibers and fiber combinations.

In addition to "Shawmut" belting duck, long-known as a standard among cotton belt fabrics, Wellington Sears has developed fabrics "fiber-engineered" to meet special requirements—such as unusual strength combined with minimum weight and bulk. These fabrics give you performance-plus—service-plus—features because they utilize to the full the unique qualities of cotton, nylon, high-tenacity rayon and other fibers... singly or in combination.

You'll find other Wellington Sears fabrics for various mechanical rubber products, coating applications and specialties, listed below.

Write for your free copy of "Modern Textiles for Industry" which includes pertinent information on rubber applications. Address: Wellington Sears Co., Department L-5, 65 Worth Street, New York 13, New York.

Superior Fabrics for the Rubber Industry

- Belting duck
- Hose duck
- Enameling duck
- Army duck
- Single and plied-yarn chafers
- Sheeting
- Airplane cloth
- Balloon cloth
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the RUBBER-TO-METAL ADHESIVE for Static and Dynamic Uses in the Automotive and Aircraft Industries

TY-PLY 'S" is an effective bonding agent for Neoprenes and Buna N's to a wide variety of metals (ferrous, brass, aluminum, magnesium, tin, etc) for static and dynamic uses in the automotive and aircraft industries. No special primer needed for each type of metal.

TY-PLY Q or 3640 for bonding Natural and GR-S

TY-PLY BN for bonding N-types

TY-PLY will adhere most vulcanizable rubber compounds to almost any clean metal surface

Marbon

MARBON CORP.

GARY, INDIANA

SUBSIDIARY OF BORG-WARNER

TY-PLY has stood the test of time . . . since '39

The Pushcart Expedition

"We're going to Zion with our carts,
And the spirit of God within our hearts."
(Song of the pushcart emigrants.)

Though the incident may be little known today, the pushcart expedition of the late 1850's is one of the most unusual stories in American history. Surely, it is one of the most unique in the annals of transportation of people and their goods.

This endeavor is connected with the early history of the Mormon church, and was devised to bring to the Salt Lake City area at low cost converts gained by the church in England and Europe.

Iowa City was the point of outfit. Here emigrants were given a pushcart, wt. 60 lbs. unloaded, on which to carry their possessions and part of the supplies across the long, intervening stretch of plain and mountains. Only enough ox-teams and wagons were furnished, on a company basis, to haul tents, extra provisions and those who were unable to walk. (When these wagons broke down and became beyond repair, as often happened, their contents were shifted to the pushcarts.) More than 4,000 emigrants reached "Zion" in this manner, one group making the trip in half the time of a wagon train.

How far man has progressed in the century since the pushcart emigrants struggled across almost half a continent. Even such a commonplace article as a bicycle wheel and tire would have seemed like a miracle from "Zion" itself to those who pushed the cumbersome carts. A pair of such tires would have outlasted the hickory and iron of the wheels, taken the weariness from many a mile.

Many factors have contributed to the progress man has made in transporting himself and his products. Speed, however, was made possible with the inflated rubber tire; and today's rubber tire with its built-in strength and long-life, is made possible by carbon black.

UNITED CARBON COMPANY, INC.

Kosmos 20 is the semi-reinforcing (SRF) black of distinction. It is a highly scientific product made with the greatest care. Therefore it is reliably uniform.

Kosmos 20 is finely balanced for cool mixing, easy processing, fast and smooth extrusion, moderate reinforcement, high resilience, low heat build-up, superior aging, and good resistance to flex.

Kosmos 20 is the choice for tire body stocks, butyl tubes, bead insulation, motor mountings, wire jackets, hose, footwear, and thousands of mechanical goods.

United blacks are the bulwark of many rubber items. Depend on United blacks to make your products supreme.

UNITED CARBON COMPANY, INC.

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NEW YORK AKRON CHICAGO BOSTON MEMPHIS

The finest name in Rutile Titanium Dioxide

Glidden ZOPAQUE*-R

...gives you a whiter white...and it's easier to grind

Glidden research has achieved greater whiteness and a highly accelerated dispersion rate in new Glidden ZOPAQUE-R. These new developments combine to produce pigments with exceptional hiding power, outstanding gloss and color retention and low reactivity.

Write today for more details on new Glidden ZOPAQUE-R, the finest name in Rutile Titanium Dioxide.

ZOPAQUE-R33—For latex paints
ZOPAQUE-R66—All-purpose Rutile
ZOPAQUE-R88—Non-chalking Rutile

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Another achievement of Glidden Planned Research

QUALITY Glidden PRODUCTS

*Trade Mark Reg. U. S. Pat. Off.

NOW...get Flo-Mix by the CARLOAD!

Buffalo's new powdered reclaim is in volume production to meet the demands of industry!

Rubber producers everywhere have been quick to recognize the advantages of the new "reclaim-that-pours" and we have been deluged with orders for large quantities. Until recently, production of "Flo-Mix" has been on a limited basis, but now we've started making shipments by the CARLOAD. Our production schedule will allow us to handle your orders, be they large or small, without delay.

"Flo-Mix", packaged in bags of *uniform* weight, is much easier to handle and is adaptable for automatic weighing and conveying. For these reasons, and because "Flo-Mix" is faster in mixing and blending, substantially *lower costs* are possible. "Flo-Mix" is especially suited for tire treads and sidewalls, molded mechanicals, footwear, soles and heels and industrial belting.

If you have a need for a faster processing, easier handling reclaim, write today for details, test sample and quantity prices on "Flo-Mix, the reclaim-that-pours." Always keep reclaims in your formula and always look to Buffalo for the best. U. S. Rubber Reclaiming Company, Inc., P. O. Box 365, Buffalo 5, N. Y. Trenton agent: H. M. Royal, Inc., 689 Pennington Ave., Trenton, N. J.

70 years serving the industry solely as reclaimers

U.S. RUBBER RECLAIMING COMPANY, INC.

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by F.D.A.*

Cabflex Di-BA

ODORLESS TASTELESS COLORLESS

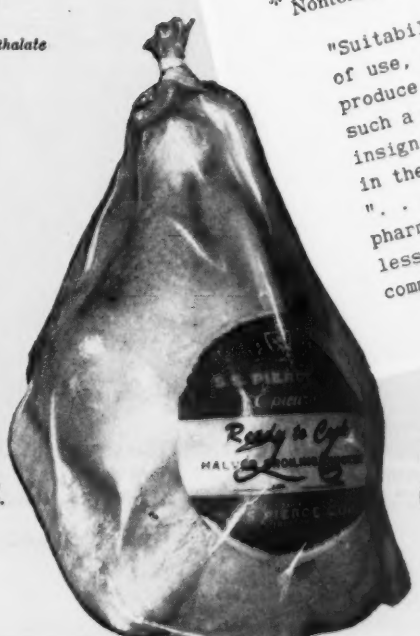
DI-ISO-BUTYL ADIPATE

* Nontoxic means "suitable" for use in food packaging materials.

"Suitability means that under the conditions of use, and in the amounts now employed to produce a finished film, di-iso-butyl adipate has such a low order of solubility as to be insignificant as a food contaminant when weighed in the light of the toxicological evidence." ". . . this plasticizer has had adequate pharmacological study demonstrating its harmlessness in the amounts now used in finished commercial films . . ."

Reprinted from Association of Food & Drug Officials of the United States Vol. XV, No. 3, July 1951

- **Cabflex Di-OP** *di-iso-octyl phthalate*
- **Cabflex DOCP** *di-iso-octyl capryl phthalate*
- **Cabflex Di-OA** *di-iso-octyl adipate*
- **Cabflex DDP** *di-decyl phthalate*
- **Cabflex DDA** *di-decyl adipate*
- **Cabflex Di-BA** *di-iso-butyl adipate*
- **Cabflex Di-OZ** *di-iso-octyl azelate*
- **Cabol 100** *hydrocarbon oil plasticizer*



Cabot produces the nontoxic plasticizer Cabflex Di-BA and does not make the finished film.

Plastics Chemicals Division

GODFREY L. CABOT, INC.

77 FRANKLIN STREET, BOSTON 10, MASS.

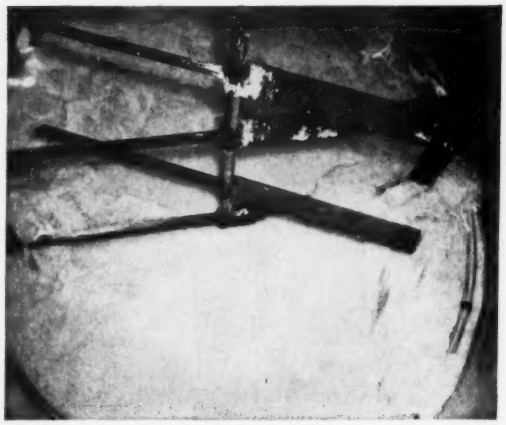
CABOT

EMULSIFIERS AND INITIATORS SPECIALLY DESIGNED FOR GR-S

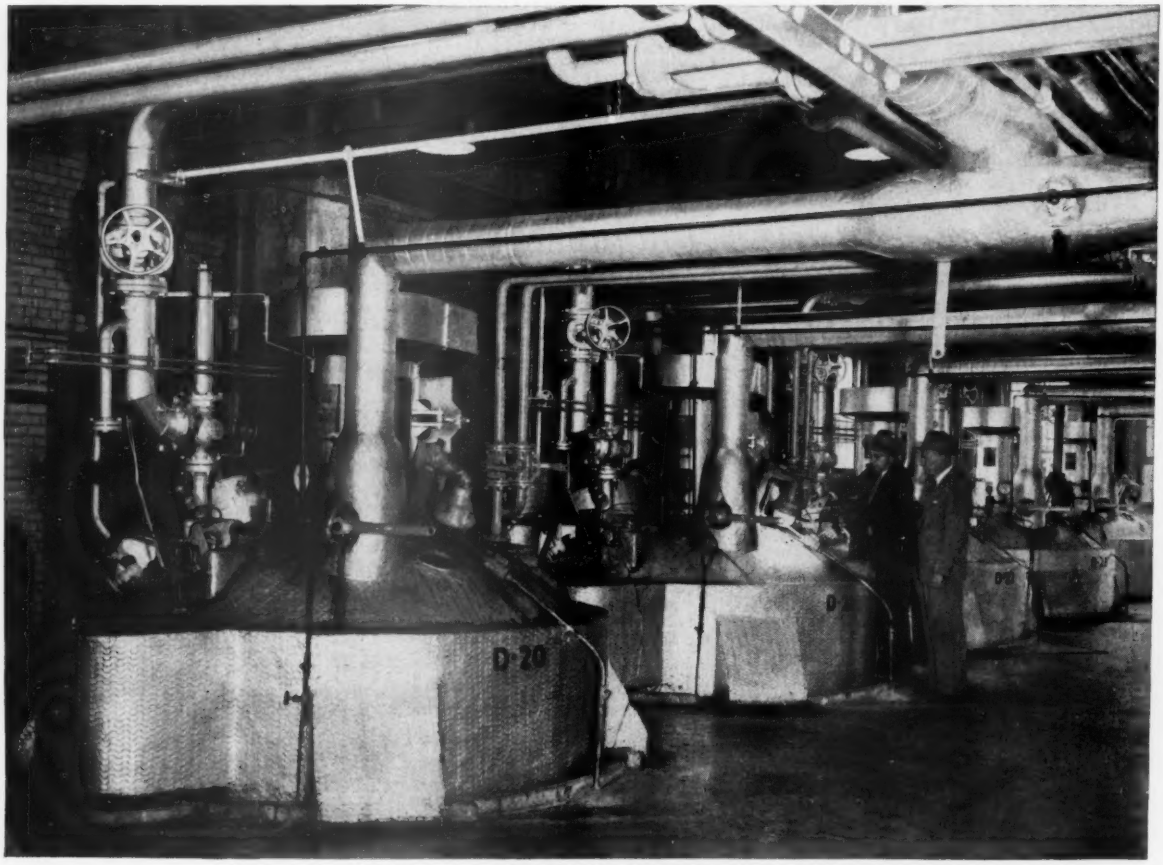
Hercules pioneered in the development of emulsifiers and initiators which were essential to the perfection of various grades of GR-S, particularly cold rubber. Today, these rosin derivatives are widely recognized by the synthetic rubber industry for their contributions to accelerated production cycles and superior product performance.

Hercules emulsifiers include Dresinate® 214 and 731—which offer optimum tensile strengths, elongation, and tear resistance in GR-S formulations. There are three Hercules hydroperoxides —Cumene (CHP), Para-Menthane (PMHP) and Diisopropylbenzene (DIBHP)—all noted for their stability and high polymerization action, especially at low temperatures.

HERCULES POWDER COMPANY
INCORPORATED
918 Market Street, Wilmington 99, Delaware



One step in the production of Dresinate—a digester at the Hercules plant in Hattiesburg, Mississippi. Here, as throughout all processing operations, quality control assures a uniformly high-quality product.



Section of a GR-S plant operated by B. F. Goodrich Chemical Company in Port Neches, Texas, where Hercules emulsifiers and initiators are used in the polymerization process.

IR53-2

REMEMBER THE "Half-Sole" TREAD?

. . . It was introduced in 1914 by GATES

In those early days of motoring, when tire mileage seldom exceeded 5,000 miles, Gates' new international "Half-Sole" Treads quickly won the acclaim of motorists by enabling them to increase this standard significantly. Many of today's rubber industry people — and many motorists too — will remember the unique "I H" design of the Gates "Half-Sole" Treads, and the picturesque slogan: "You Half-Sole Your Shoes . . . Why Not Your Tires?"

The Gates "Half-Sole" is well-remembered here at Bridgwater. Like *most* of the famous treads in rubber industry history, it came from molds of our own manufacture. But long *before* the "Half-Sole", Bridgwater's mold-making technology was advancing the standards of tire mold quality. Since 1906, in fact, we have worked closely with the rubber industry, *helping* it advance the standards of tire performance by furnishing custom-built molds for more efficient, more economical production of quality automotive tires.

Typical of the advanced nature of the mold-making service Bridgwater makes available to the tire industry today, are the modern, *complete* facilities of our Athens Machine Division, the only plant in the world devoted *exclusively* to tire mold manufacture.

Here, automotive tire molds of any size or type — in steel, cast iron or aluminum — are precision-built by long-experienced Bridgwater technicians and craftsmen. And their sole job is to produce higher quality molds for the tire industry — at exceptionally favorable costs.

ATHENS MACHINE DIVISION

THE BRIDGWATER MACHINE COMPANY

Akron, Ohio

1785

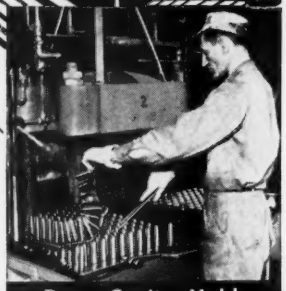
DOW CORNING Mold Lubricants Add Sales Appeal

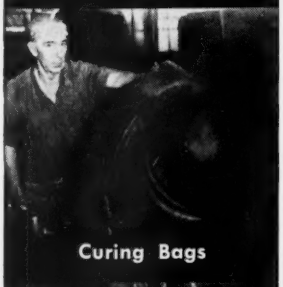
"Show 'em and sell 'em!"

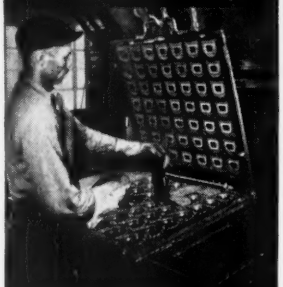
Experienced salesmen know that product appearance is often the deciding factor in successful selling. And experienced pressmen know that clean, easy release is a deciding factor in successful production.

Get 'em both with Dow Corning silicone mold lubricants. Your molds stay cleaner longer, and they produce parts with a high glossy finish that's bound to mean greater customer appeal. That's because these silicone release agents can't break down at molding temperatures to form a carbonaceous build-up. Non-flammable and non-corrosive, they help cut mold cleaning costs as much as 80%. Scrap is reduced to the vanishing point.

Specify Dow Corning silicone mold release agents today. Fluids for green carcass, bead and parting line release; emulsions for molds, mandrels and curing bags.


Deep Cavity Molds


Curing Bags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ATLANTA CHICAGO CLEVELAND DALLAS DETROIT LOS ANGELES NEW YORK WASHINGTON, D. C. (Silver Spring, Md.)

In Canada: Fiberglas Canada Ltd., Toronto In Great Britain: Midland Silicones Ltd., London

HI-SIL . . . for basketballs that can take it

Basketballs take a lot of punishment. They are banged, bounced, dribbled, slammed, spun, and whipped. The abrasion in a single game between the ball and the floor, and the ball and the bankboard, is extreme.

That's why basketball covers have to be rugged. To help make them that way, the MacGregor Company, leading sports equipment manufacturer, developed a scientifically designed rubber cover marketed under their tradename "Plylon." It is one of the toughest and most tear-and-scuff-resistant covers known; it is moisture-proof and feels almost like leather.

Hi-Sil®, the white reinforcing pigment developed by Columbia-Southern®, is the secret of this new rubber compound's exceptional resistance to abrasion and tear. The particles of Hi-Sil are extremely fine—it would require over 2 billion to cover a pinhead—and they are uniformly dispersed in the compound.

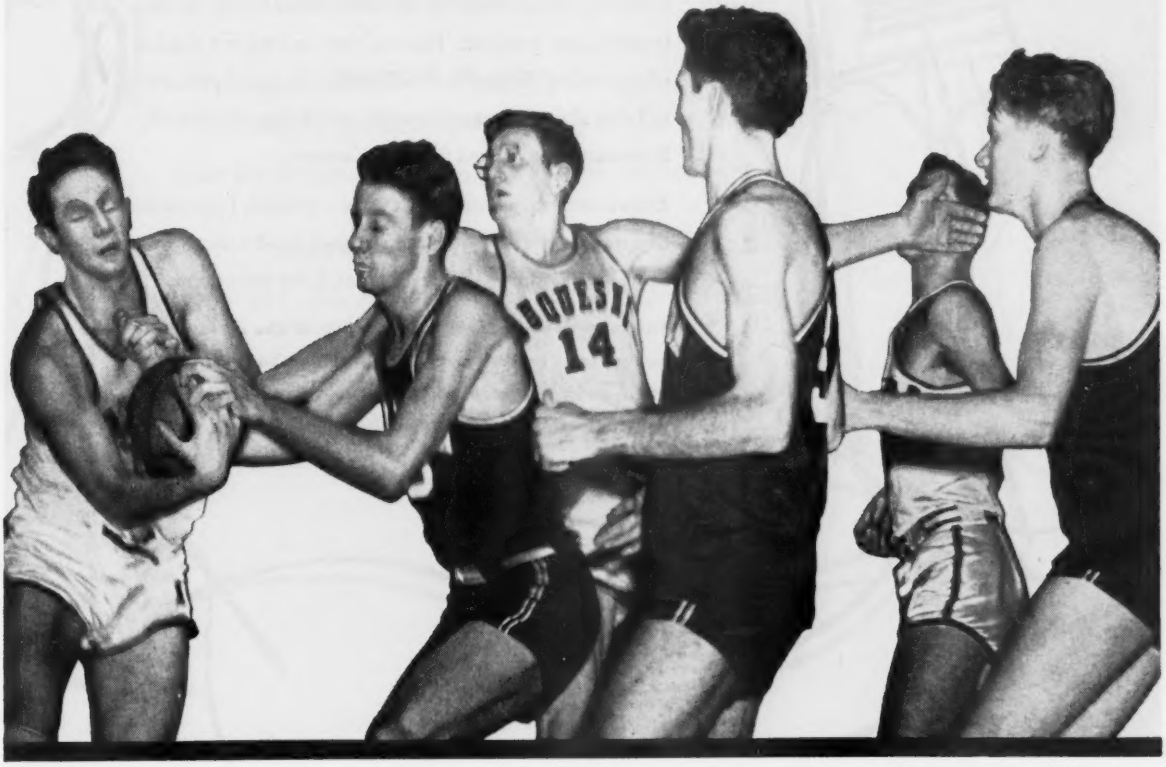
Hi-Sil is one of numerous chemical specialties produced by Columbia-Southern that augments its basic production of chlorine, caustic soda, soda ash and other alkalies.

The Columbia-Southern Pigment Family

Hi-Sil, together with Silene® and Calcene,® comprise Columbia-Southern's family of non-black reinforcing pigments.

These pigments are used in a multitude of white and colored rubber products for tensile strength as well as for increasing tear and abrasion resistance. A few of these applications include rubber soles and heels, wringer rolls, cable insulation, garden hose, white sidewall tires, and various molded goods.

For further information on any of the three Columbia-Southern pigments, or for experimental working samples, write today.



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Improved strength Tire Cord built

FROM A RECENT PRESS RELEASE:

"Dr. Martin Wadewitz, Technical Vice President, American Enka Corporation, announces that the entire output of the company's High Tenacity Yarn is now being produced in a new improved type of yarn which is being sold at the same price as the former yarn.

Consumers of American Enka High Tenacity Yarn have effectively collaborated in the furtherance of this product improvement program. The new yarn embodies a number of processing changes and refinements designed primarily to bring about increased strength and flexing endurance, important to improved tire manufacture.

Enka's own experiments indicating a strength improvement of approximately 10% in various cord constructions have been confirmed by the tests of Enka yarn users."

This new development is indicative of the strides being made by research in improving the potentials of rayon in the world of the future... in bringing you tomorrow's progress today.

ENKA RAYON FOR

at no extra cost... with Enka Rayon yarn

Why this is important news for you...

AND WHY YOU SHOULD SPECIFY TIRES MADE OF RAYON CORD

RAYON IS STRONG:

reduces to a minimum blow-outs and carcass failures.

RAYON IS COOL:

withstands grueling heat built up inside the tire by day-in day-out over-the-road operation.

RAYON IS ECONOMICAL:

low in initial cost, low in upkeep, low in cost per mile.

ENKA IS A MAJOR PRODUCER OF RAYON FOR TIRES

CORD IN TIRES

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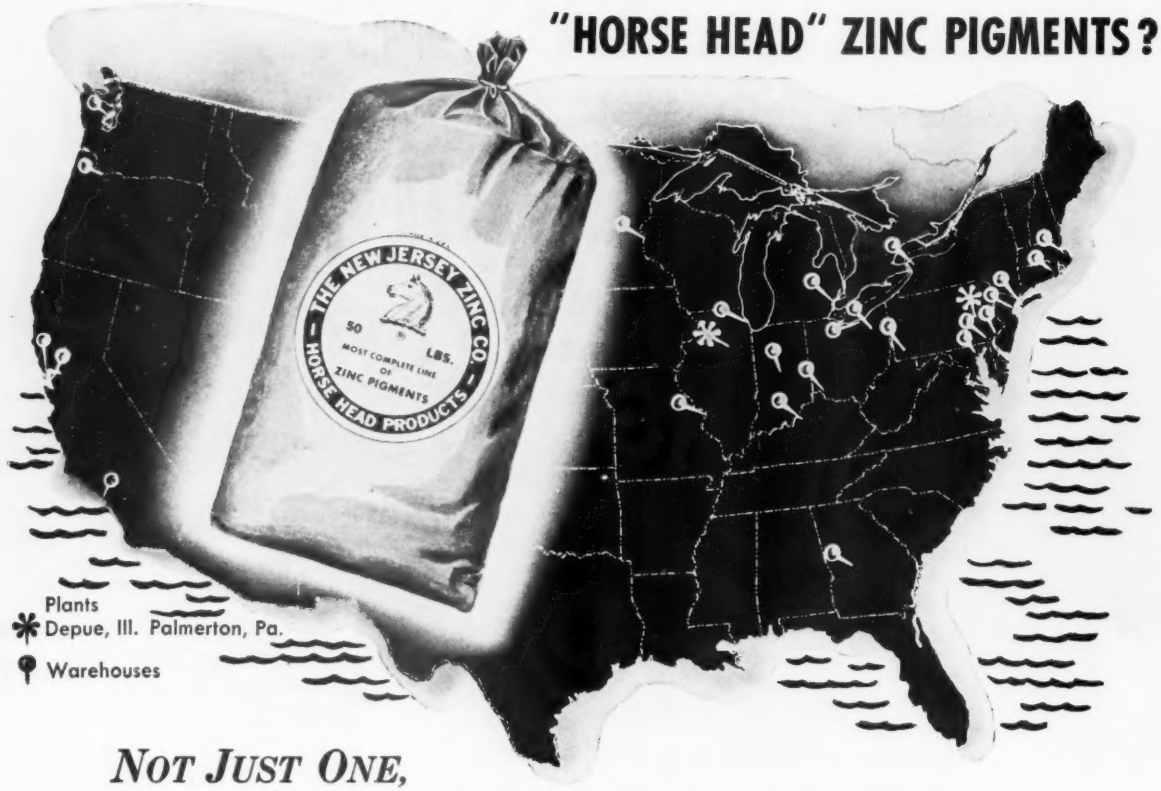
Which of these 26 depots ensure YOUR supplies of

"HORSE HEAD" ZINC PIGMENTS?



NOT JUST ONE,

but several, of these warehouses guard your requirements for the various brands of Horse Head zinc pigments — wherever you are.

Whether you need a regular L.C.L. shipment or an emergency supply between carloads, you can count on Horse Head warehouses to protect your production schedules.

This is why:

1 The Horse Head distribution system consists of an integrated nationwide network of warehouses:

5 on the Pacific Coast
10 in the Midwest
11 in the East and South

2 An unexpectedly heavy call on any one is promptly met by shipments from one or more of the others nearby.

Thus you get maximum delivery service:

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Founded 1848

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—at high speeds . . .

. . . with Fidelity's method of HOSE reinforcement

You can knit natural and synthetic yarns at speeds up to 1,000 feet per hour on rubber and plastic extrusions in continuous lengths. Hose is strong and *flexible*, adhesion is better, diameters are uniform.

By eliminating costly rewinding, treating and drying operations, electrically controlled Fidelity Hose Reinforcement Machines are setting new economy records in plants where they replace conventional braiders. These machines have been time tested by the world's leading Rubber Hose Manufacturers for nearly 20 years.

Write today for Catalog HR describing advantages and technical details. When in the Philadelphia area, visit the new showroom at our plant and see the Fidelity Hose Reinforcement Machine in operation.

Designers and Builders of Intricate, Automatic Precision Machines

SINCE 1911

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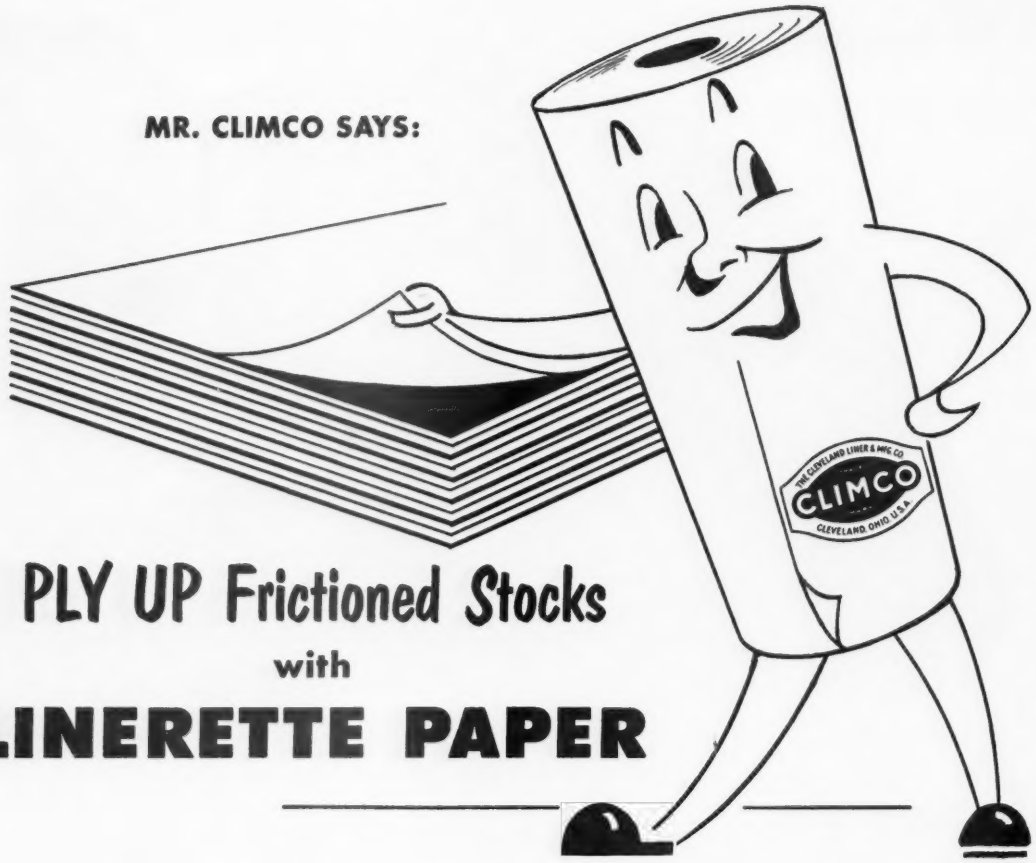

PLY UP Frictioned Stocks with LINERETTE PAPER

You will save time and money by using Linerette separating paper to ply up frictioned stock before cutting in the clicking operation. Frictioned stock can be fed from the calender right into Linerette. This specially processed paper contains no oil or wax, prevents adhesion and insures fast, clean separation . . . leaves no cloth marks.

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- **Used in rolls or sheets with most types of lightweight stocks.**

Linerette is available in any width up to and including 54″, in rolls of 9″, 11½″, 13″ and 15″ diameters, on cores of 3″ i. d. The yield is approximately six square yards to the pound. A 9″ roll contains approximately 375 linear yards and a 15″ diameter approximately 1150 linear yards. *Ask for a sample today, just specify desired width.*

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Cable address: "BLUELINER"

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THE CLEVELAND LINER & MFG. CO. CLIMCO CLEVELAND OHIO, U.S.A.

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INTERLEAVING PAPER

MADE BY THE MANUFACTURERS OF *CLIMCO* PROCESSED LINERS

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AZO-ZZZ-44 and AZO-ZZZ-55 assure good dispersion and easy processing because of their uniform particle size and absence of extreme fines. With AZO-ZZZ-11, 22, 33, (Acicular types) and special grades, a complete range of zinc oxides is offered for every rubber requirement.

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Adaptable to a wide range of material widths, coating thicknesses and operating speeds

● This IOI Knife-Type Spreader-Coating Machine has an impressive record for increasing production and lowering production costs in processing operations where knife-coating is the most practical solution to the coating problem. It is especially efficient for applying high-viscosity compounds such as organosols, plastisols and adhesives.

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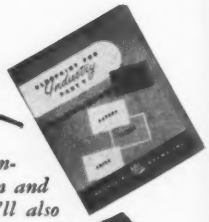
This coater merits your consideration now—or whenever you plan to modernize your coating operations. Many users are employing it today with outstanding success in a wide variety of applications. It is available with or without drives—*and its price is surprisingly low for a machine of such high quality.*



Write for complete information and specifications. We'll also send you, upon request, this highly informative IOI *book, "Coating and Handling Equipment for Textiles, Papers, Films and Foils."*

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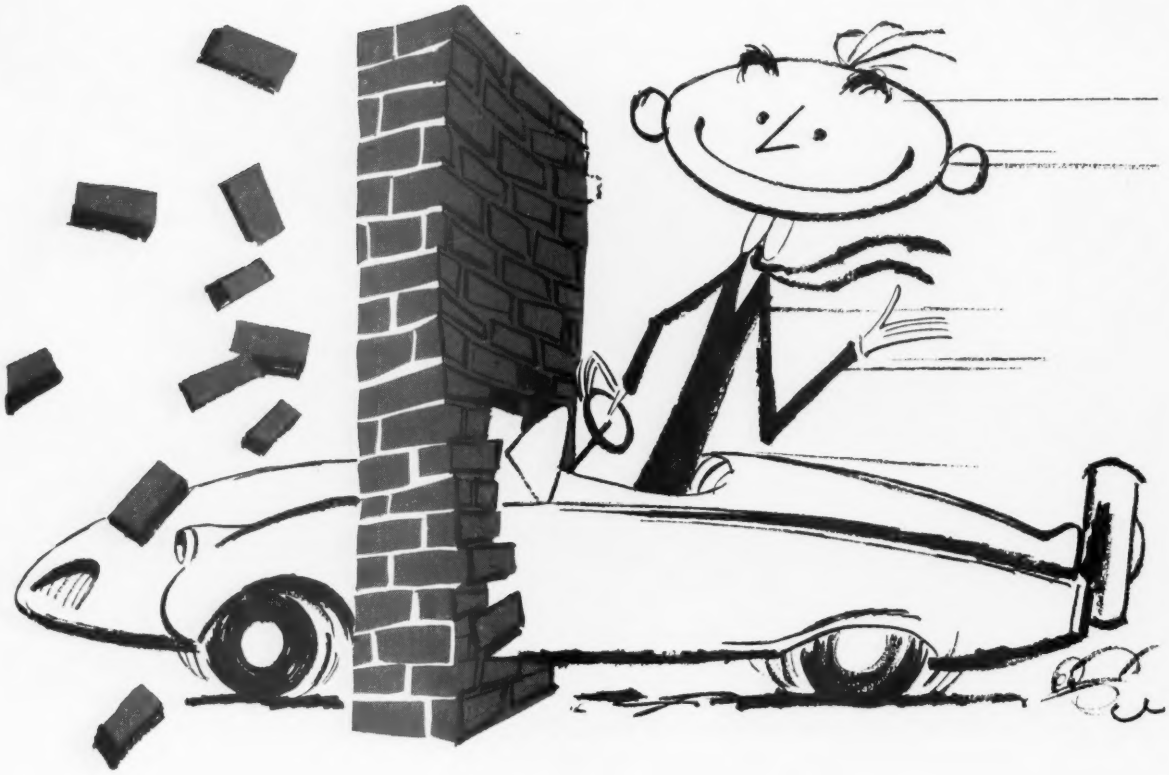

How to get **Better Polyesters**

at Low Cost

Can you mold a glass reinforced polyester that's strong enough to push over a brick wall and inexpensive enough to compete in the auto body market? Perhaps not today. But someday you may be called on to meet specifications almost that tough. And when you are, you'll probably be relying on a DIAMOND ALKALI Calcium Carbonate as a filler to help you get smoother surfaces, decreased shrinkage, improved wet strength and *lower cost*.

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Suspenso®—particle size about 5 microns.

Surfex®MM—Same as Suspenso, coated with 1% resin.

Multifex®MM—Uncoated, particle size about .06 microns.

Kalite®—Size about 1 micron, coated with 1% stearic acid.

For more information, specific formula suggestions and technical assistance, call your nearest DIAMOND Sales Office or write DIAMOND ALKALI Co., 300 Union Commerce Bldg., Cleveland 14, Ohio.

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DIAMOND ALKALI COMPANY

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The Right Combination for rubber and plastics equipment, planning and processing

An experienced **Engineering Organization** with the **"KNOW-HOW"** of rubber and plastics process engineering and machine design.

A machinery manufacturing plant with the "KNOW-HOW" resulting from years of experience in building quality equipment.

the whole job from idea to production or any part thereof

This combination of Hale and Kullgren, Inc., and The Aetna-Standard Engineering Company offers a complete service to the rubber and plastics industry. We are equipped to deliver a complete plant, a specialized process, an engineering service or individual machines for processing rubber and plastics. For instance, some of our current projects are—a Phenolic Resin Molding Powder Plant; a Tire Manufacturing Plant; a Process for Manufacturing Plastic Pipe; a Compounding System and Mill Room for Mechanical Rubber Goods Plant.

We also engineer, build and service the famous National Erie line of rubber and plastics processing equipment.

If you need experienced and competent help in processing or manufacturing—call on us.

your inquiry

Whatever your requirements in plastics or rubber equipment or planning, address your inquiry to:
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Give us an outline of your needs and we will give you prompt and authentic information.

National Erie products for the Plastic and Rubber Industries • Extruders • Simplex Doors for Autoclaves • Mills and Hydraulic Presses.

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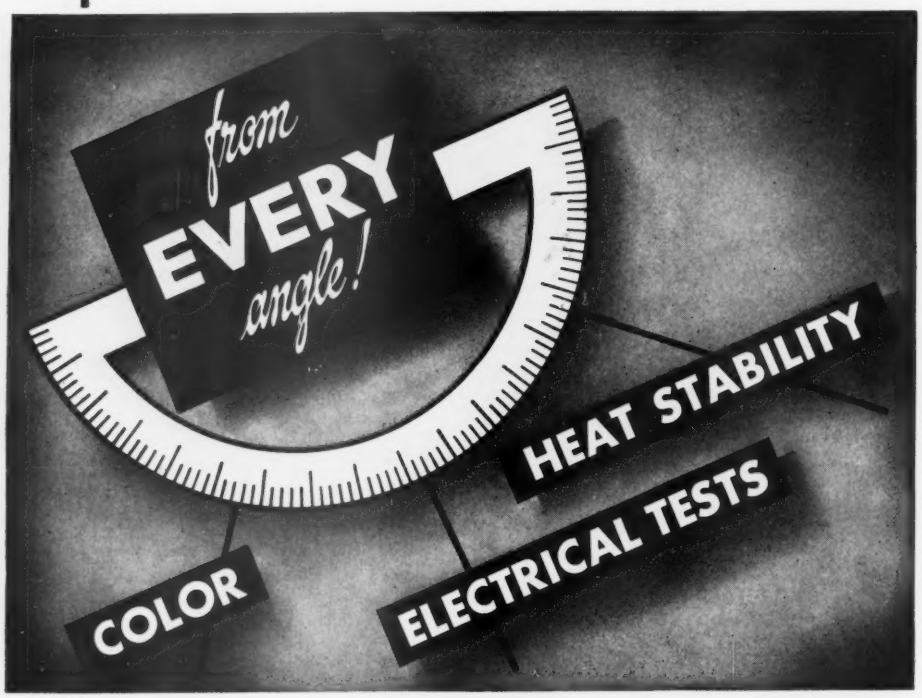

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Sample and technical data sent promptly on request

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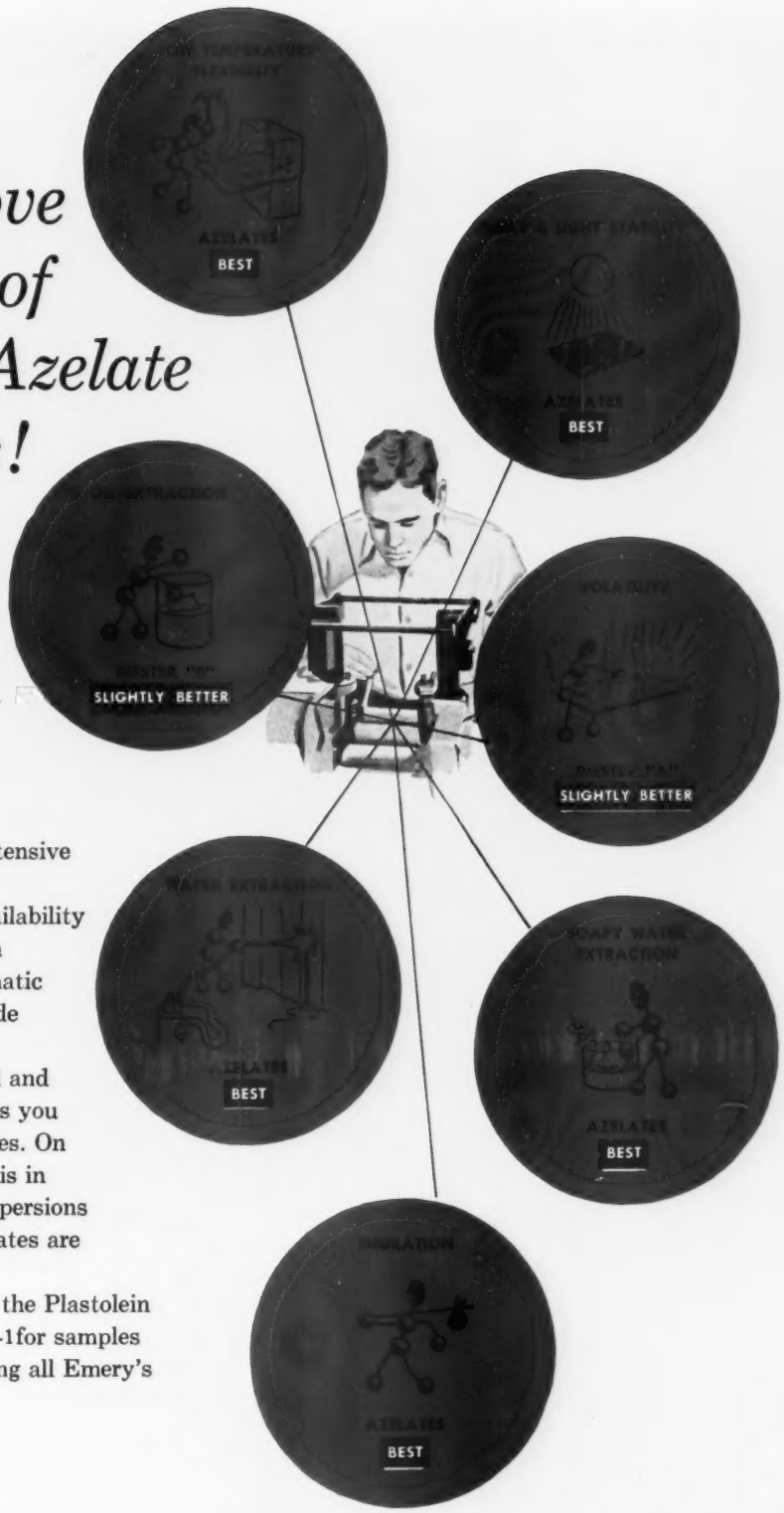
Tests Prove Superiority of Plastolein® Azelate Plasticizers!



DIRECT COMPARISON PROVES ADVANTAGE OF AZELATES OVER OTHER ALIPHATIC DIESTER PLASTICIZERS!

It will pay you to start an extensive evaluation of the Plastolein Azelate Plasticizers. With availability increasing, the choice between these Azelates and other aliphatic diester plasticizers can be made on performance alone.

Check the points illustrated and see for yourself the advantages you get from the Plastolein Azelates. On a performance versus cost basis in films, sheeting, extrusions, dispersions and coated fabrics, these Azelates are your best buy today.

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For 30 years PARA FLUX has been the Standard of the Rubber Industry, its quality is always the same whether you are a drum or tank car user.

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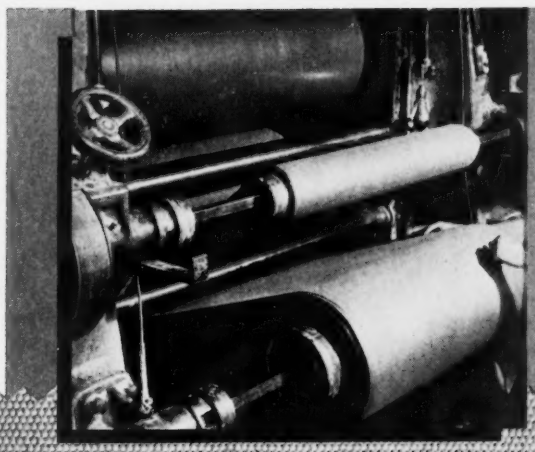

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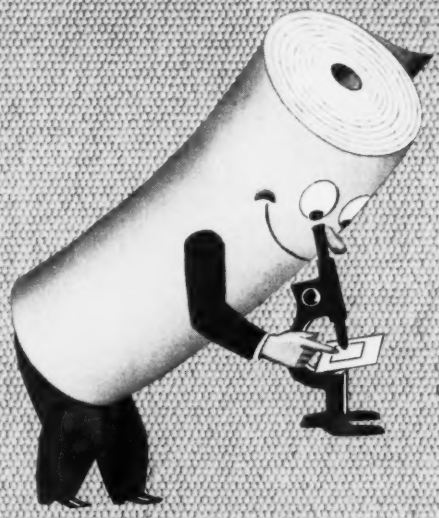
Makes The Big Difference In
INDUSTRIAL FABRICS

MT. VERNON FABRICS



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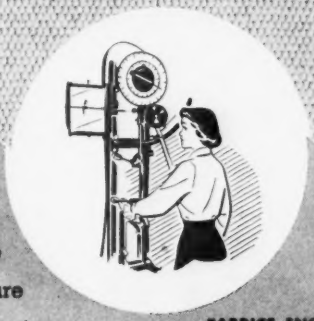

Determining Yarn Tensile Strength with 300-lb. vertical test. One of a series of comprehensive laboratory controls throughout production to assure uniformity in all Mt. Vernon-Woodberry products.

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Need adaptation of an existing fabric to your special purposes? Or creation of an entirely NEW fabric — cotton, synthetic or blend — to meet your specifications? Mt. Vernon-Woodberry's staff of textile engineers is available on request to help you with your problems in development or application of industrial fabrics.

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FOR TRUCK & CARLOAD SHIPMENTS OF

ZINC OXIDE

NOW AVAILABLE AT NO ADDITIONAL COST

THE ST. JOSEPH LEAD COMPANY after several years of experimenting, has developed for its zinc oxide customers a loading method known to the trade as "unit load." This new method has been worked out successfully for both truck and carload shipments with a number of zinc oxide users who have adopted it as a standard practice for their shipments. This service is provided at no additional cost to the customer, and has resulted in a saving of up to 50% of the unloading cost of bag by bag handling. Each unit-load is compressed to about 75% of its original volume, which results in increased storage capacity. Improved material handling, and greater cleanliness are other advantages gained by this method.

OUR 6-PAGE ILLUSTRATED FOLDER, CONTAINING DETAILED OPERATING DATA ON THE ST. JOE UNIT-LOAD METHOD IS YOURS FOR THE ASKING.

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Plant & Laboratory:
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GEN-TAC LATEX*

(THE PROVEN VINYL PYRIDINE LATEX)

prevents moisture degradation

This looks like a bruise break but it was caused by moisture entering a puncture. The superior adhesion of Gen-Tac dips persists under such unfavorable conditions and prevents such failures!

THE GENERAL TIRE & RUBBER CO.

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CHEMICAL DIVISION • AKRON, OHIO

GTR

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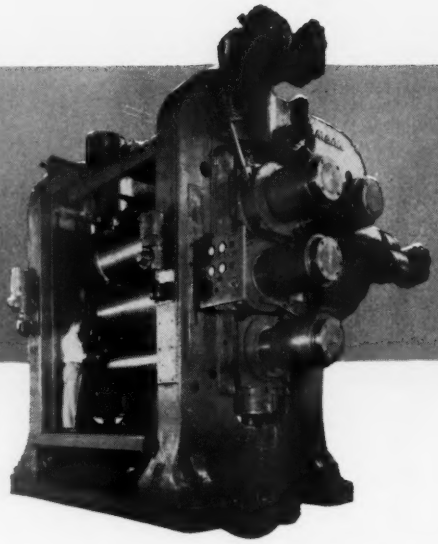
Chemical Products

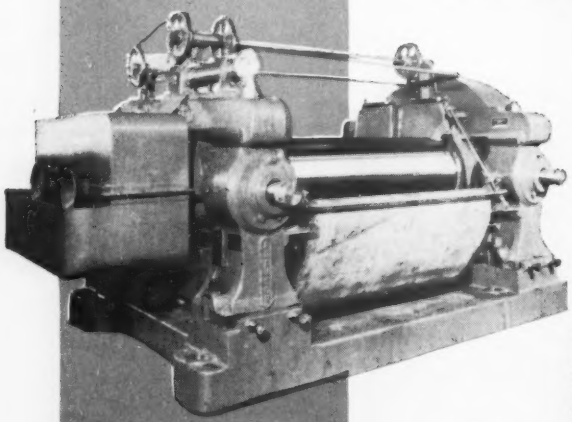
CALENDERS

We make all types and sizes of Calenders, precision designed for extremely close tolerances to meet the most exacting requirements in the production of plastics film or the coating of fabrics with rubber or plastics. The unit shown is an ADAMSON UNITED 32″ x 92″, 4-Roll Plastics Calender geared to produce 72″ wide vinyl film, 2 mils. or less in thickness at speeds to 150 YPM.



RUBBER and PLASTICS —

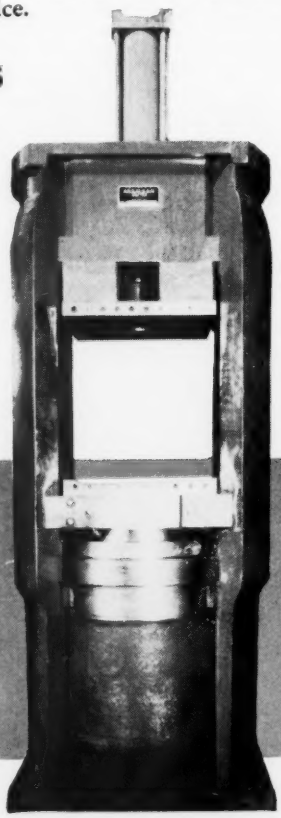
... designed and built by...



We engineer and build all types of individual production units and complete electronically controlled trains with all accessories for every Rubber or Plastics processing requirement. Our highly specialized engineering and production facilities plus the combined research and technical abilities of United Engineering and Foundry Company, and the manufacturing capacity of eight modern plants, are at your service.

PRESSES

We build all types of presses for the rubber, plastics and plywood industries. Shown is a new 24″ ADAMSON UNITED BARREL TYPE PRESS with transfer cylinder. This new press, an exclusive ADAMSON UNITED development, exerts up to 76% more platen pressure than conventional types without change in present hydraulic lines. Stock is transferred into the mold cavities through sprues which reduces cure time and flash trimming to a minimum. Sizes range from 12″ through 32″ with larger sizes available to specification. Presses Catalog No. 462 on request.

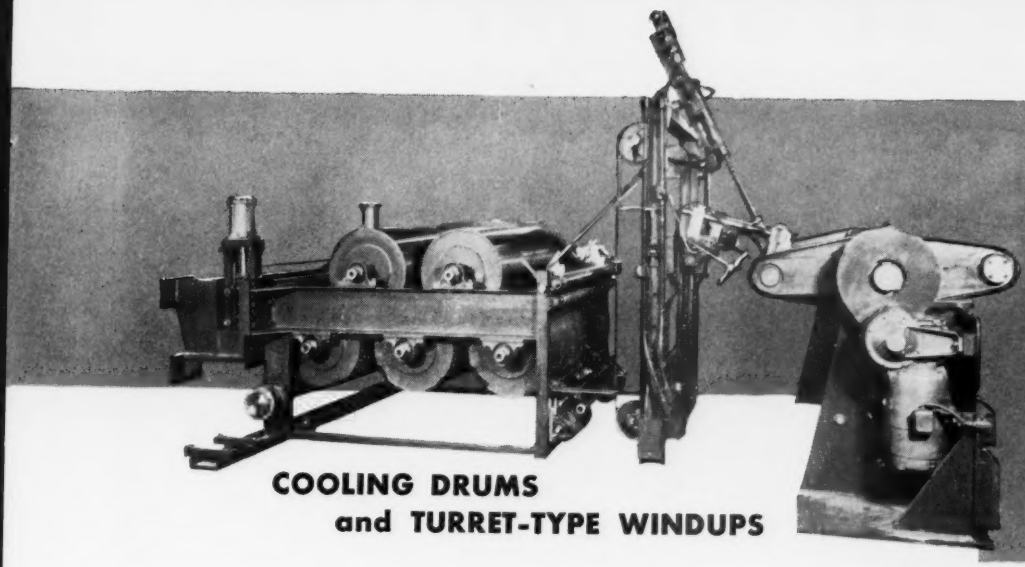


MILLS

An 84″ Individual Mill equipped with a mixing apron. ADAMSON UNITED Mills may be had in all sizes from 6″ x 16″ to 28″ x 84″, driven individually; in pairs with right angle reducer between the units, or grouped on a line shaft with reducer at one end of the shaft. Apron, as shown, can be installed on any type of existing mill. New catalog No. 463 on request.

AUTOCLAVES or VULCANIZERS

Built to specific requirements from 18 inches to 15 feet in diameter, any length, vertical or horizontal to withstand internal pressures as high as 1000 lbs.-per-square-inch. The Pot Heater shown is a vertical, cylinder-opecated Breech-door type. Write for Vulcanizer Catalog No. 461.



COOLING DRUMS
and TURRET-TYPE WINDUPS

This is a standard type of accessory equipment arrangement for plastics film. It consists of embossing equipment; cooling unit; slitting devices; compensator stand and automatic turret windup. The turret windup stand is a center-drive-type with automatic indexing equipment, yardage counter, and adjustable tension control. We design and build entire calendering process systems including all accessory equipment.

PRODUCTION UNITS

.....ADAMSON UNITED

BRAKE and TIRE TESTING MACHINES

Installation shows an 84" Adamson United High-Speed Jet Airplane Brake and Tire Testing Machine of the inertia type. We have built similar machines as large as 16 feet in diameter for speeds up to 250 M.P.H. and tire loads to 150,000 pounds.

Wire, phone or write us today. No obligation.

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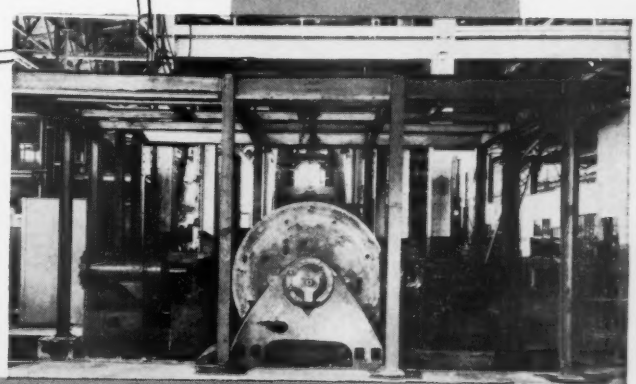
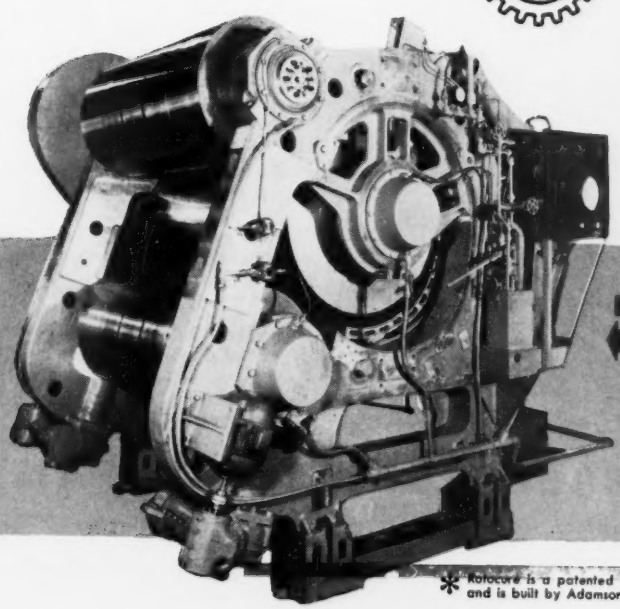
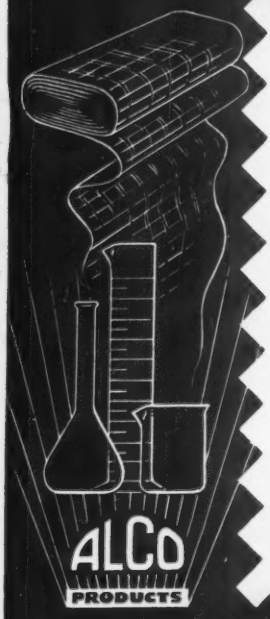




ROTOCURE*

A new machine for the continuous curing of all flat rubber or plastics articles with smooth or designed surfaces. Rotocure increases production through continuous operation without opening, cooling, reheating and closing. It eliminates overcuring or undercuring of the over-lap areas occurring on conventional presses. Roll and belt changes, incident to design requirements, can be made on this new 60" x80" Rotocure in one-tenth the time formerly required.

* Rotocure is a patented development of Boston Woven Hose and Rubber Co. and is built by Adamson United Co. under a licensing arrangement.



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The VULCANOLS REPRESENT a group of durable textile finishes which, when coated on textile fabrics, provide fiber conservation, pile anchorage, non-skid properties, slip resistance, and resistance to raveling or fraying.

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We point with pride not only to a complete line of solid Brown, White, "Neophax" and "Amberex" grades, but also to our hydrocarbon solutions of "Factice" for use in their appropriate compounds.

Continuing research and development in our laboratory and rigid production control has made us the leader in this field.

The services of our laboratory are at your disposal in solving your compounding problems.

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for SUPERIOR WEATHER RESISTANCE try

INDONEX with NEOPRENE type WHV

Low-cost Neoprene WHV compounds extended with INDONEX Plasticizers (our Circular 13-47) originally showed an "O" rating after 60 days roof exposure when run in accordance with ASTM Method D-1171-51T. Now, after one year exposure in northern Illinois, these compounds remain unchanged. Such outstanding weather resistance will be of interest to all manufacturers of weather-stripping and other automotive products, insulated wire, hose and belting.

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General Bulletin 13

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HERE'S EXPERIENCE THAT CAN HELP YOU WITH YOUR PROCESSING

When you need a process aid or have a problem involving one, it will pay you to take advantage of Sun's technical knowledge and experience in the field.

As early as 1937, working with leading rubber companies, Sun made commercially available a petroleum derivative remarkably suited for plasticizing Neoprenes, natural rubbers and reclaims. This was followed by a number of other process aids—among them Circosol-2XH, an elasticator that greatly improved the rebound properties of GR-S synthetics; and Sundex-53, a low-cost product highly compatible with natural rubbers, GR-S, reclaims, and various combinations of the three. Leadership in the field and knowledge of the industry's requirements brought about Sun's participation in the experimental work which led to the development of oil-extended synthetic rubbers.

Put this experience, plus a complete line of products, to work for you—in lowering costs, in improving product quality, in solving processing problems. For the assistance of Sun's rubber technologists, write SUN OIL COMPANY, Dept. RA-1.

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THE HOLLISTON MILLS, INC.
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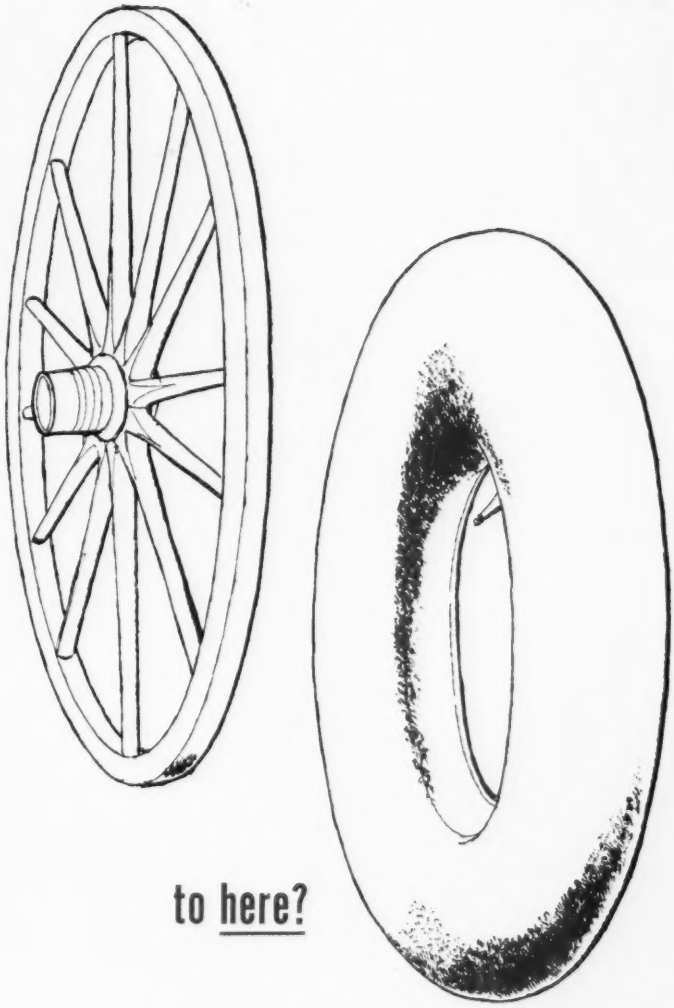
BRATEX is available in three standard qualities, 20 and 40 inch widths, 100 and 250 yard rolls. Special size rolls to order.

THE HISTORY OF THE RUBBER INDUSTRY—Number 7

how long did it take to get from here to here?



Answer: Two years.

The principle of an inner tube is simple, and of such ancient application that it could not be patented.

Inner tubes, as we think of them today, were probably used about 1890. By 1892—two years later—they were being used widely, and beginning to appear as the detachable tube, for double tube tires, and the vulcanized-in type, used in single tube tires.

Two Monsanto accelerators, Thiofide (powder) and Thiofide S (seeds), can be used successfully in a wide variety of stocks. The seeds give maximum speed and completeness of dispersion. For more information about these accelerators and other products, see catalog "Monsanto Chemicals for the Rubber Industry." If you do not have a copy, write to MONSANTO CHEMICAL COMPANY, Rubber Service Department, 920 Brown Street, Akron 11, Ohio.

MONSANTO CHEMICALS FOR THE RUBBER INDUSTRY

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Flectol* H
Santoflex* B
Santoflex BX
Santoflex 35
Santoflex AW
Santowhite* Crystals
Santowhite MK
Santowhite L

ALDEHYDE AMINE ACCELERATORS

A-32
A-100

MERCAPTO ACCELERATORS

Santocure*
El-Sixty*
Mertax (Purified Thiotax)
Thiotax (2-Mercapto benzothiazole)
Thiofide* (2,2' dithio-bis benzothiazole)

GUANIDINE ACCELERATORS

Diphenylguanidine (D.P.G.)
Guantal*

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RZ-50
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Pip-Pip
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Ethyl Thiurad (Tetraethyl-thiuram disulfide)
Mono Thiurad (Tetramethyl-thiuram monosulfide)
Methasan* (Zinc salt of dimethyl dithiocarbamic acid)
Ethasan* (Zinc salt of diethyl dithiocarbamic acid)
Butasan* (Zinc salt of dibutyl dithiocarbamic acid)

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Santovar*-A
Santovar-O
Sulfasan R
Insoluble Sulfur "60"

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Experience, a necessary ingredient in the manufacture of any product, is especially essential in roll making where only by long and intimate association with an industry, can its requirements be thoroughly understood and successfully provided for.

To United's 50 years of roll making experience can be added the advantages of its continuing program of metallurgical research, basically sound engineering and modern production facilities—a combination that made, and has kept, United Rolls favorites in outstanding processing plants throughout the world.

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When in need of rolls—for whatever requirement—consult us.

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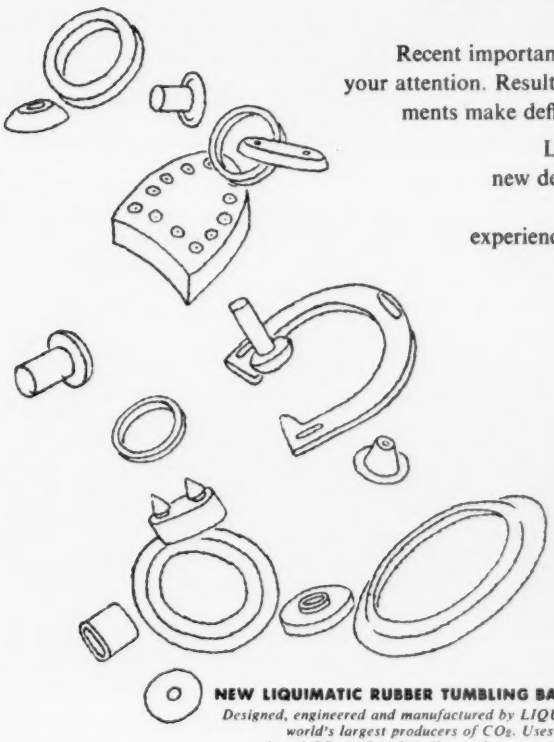
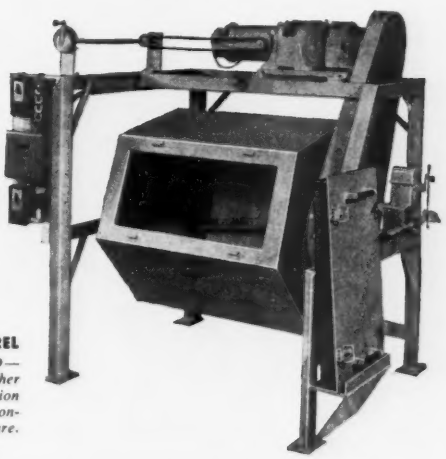
New Developments in CO_2 rubber tumbling Cut Deflashing costs



Recent important developments in CO_2 rubber tumbling deserve your attention. Results of intensive LIQUID research, these improvements make deflashing more efficient, economical and practical.

LIQUID engineers are anxious to discuss these new deflashing developments with your engineering or production personnel. These qualified, experienced experts are always available for consultation on any CO_2 or Dry Ice application. Just mail the coupon below.



NEW LIQUIMATIC RUBBER TUMBLING BARREL

Designed, engineered and manufactured by LIQUID—world's largest producers of CO_2. Uses either liquid CO_2 or Dry Ice. Heavy duty construction throughout. Stainless steel, 3" Rubatex insulated construction. Automatic control of time and temperature.

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IN WHICHEVER FORM YOU PREFER . . .

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RED DIAMOND Dry Ice

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Tank truck to CO_2 receiver.

LIQUID also produces:

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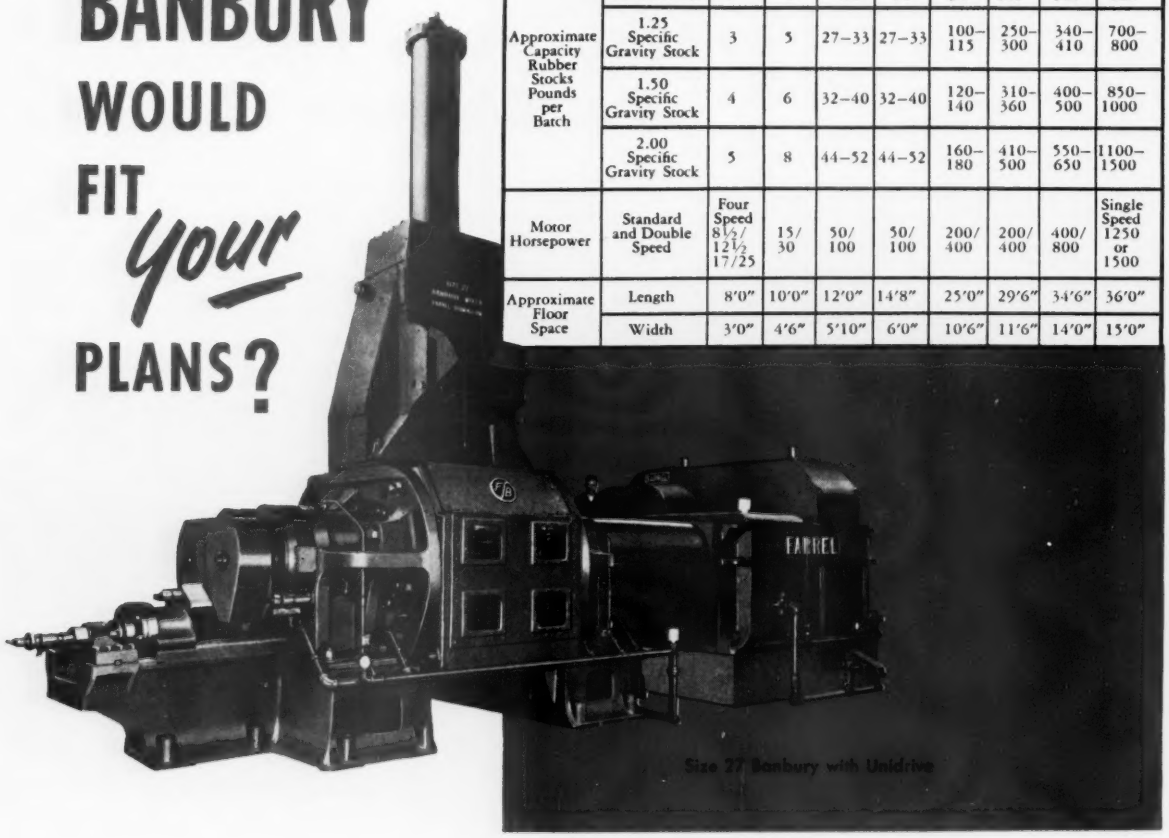
Size of Machine		B	00	1	1-A	3-A Unidrive	9	11 Unidrive	27 Unidrive
Net Volume of Chamber—Cubic Inches		103	263	1193	1193	4315	11443	14940	37709
Approximate Capacity Stiff Paste Pounds per Batch	Factor x Specific Gravity	Sp.Gr. x 2.5	Sp.Gr. x 4	Sp.Gr. x 24	Sp.Gr. x 24	Sp.Gr. x 85	Sp.Gr. x 225	Sp.Gr. x 300	Sp.Gr. x 600
Approximate Capacity Rubber Stocks Pounds per Batch	Crude Rubber	2	4	24	24	90	225	300	600
	1.25 Specific Gravity Stock	3	5	27–33	27–33	100–115	250–300	340–410	700–800
	1.50 Specific Gravity Stock	4	6	32–40	32–40	120–140	310–360	400–500	850–1000
	2.00 Specific Gravity Stock	5	8	44–52	44–52	160–180	410–500	550–650	1100–1500
Motor Horsepower	Standard and Double Speed	Four Speed 8½/12½ 17/25	15/30	50/100	50/100	200/400	200/400	400/800	Single Speed 1250 or 1500
Approximate Floor Space	Length	8'0"	10'0"	12'0"	14'8"	25'0"	29'6"	34'6"	36'0"
	Width	3'0"	4'6"	5'10"	6'0"	10'6"	11'6"	14'0"	15'0"



Size 27 Banbury with Unidrive

Your choice should not be a hard one because Banbury mixers are available in a wide range of sizes from the size B for laboratory or small production work to the huge No. 27 capable of mixing 1000 pounds of rubber stock in a single batch.

Between the laboratory Banbury and the size 27 are 5 other sizes of various capacities, some with variations in construction permitting the selection of the right machine to suit individual requirements. With such a range of machines to choose from, you can select the mixer that will provide the production you need.

Furthermore, Farrel-Birmingham engineers have developed other production units, such as extruders, warming and sheeting mills and calenders which are matched in capacity with the various sizes of Banburys. This means that a layout can be engineered that will eliminate the "choking" or "starving" of any machine in the line.

Farrel-Birmingham engineers will be glad to assist you in the selection of the right Banbury for your plans.

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FB-871

Fatty Acid Trend in Rubber Making ☆☆☆☆☆ General Mills Aliphats for Sponge Rubber ☆☆☆☆☆ Many Types Available

Have you tried using a mixture of fatty acids in the manufacture of sponge rubber products? An interesting trend has developed toward the use of special fatty acid mixtures. Experience suggests that a mixture of General Mills Aliphat 44-B (approximately 75 percent) and Aliphat 6-C (approximately 25 percent) will give you superior results.

Today's modern technology enables you to use those mixtures best suited for your specific needs.

The combination of Aliphats 44-B and 6-C, for instance, gives excellent blow in the manufacture of sponge rubber . . . leaving the rubber with a springy texture, small, even pores, and a moderate skin thickness. Aliphats 44-B and 6-C help generate the gas that blows up the rubber, help accelerate vulcanizing, help disperse the pigments within the rubber mass, and help to plasticize the rubber.

Not only will General Mills Aliphats help you produce a good sponge rubber by performing the above functions, but also, you will save money.

If you would like technical information on General Mills Aliphats (fatty acids), just mail the coupon below.

Sponge rubber being manufactured at Durkee-Atwood, Minneapolis. Fatty Acids aid vulcanizing, blow, and lubrication in rubber-making process.

In addition to Aliphats 44-B and 6-C, General Mills has specialized fatty acids for the various rubber manufacturers. For sponge rubber there are Aliphats 44-B, 6-C and 33-B; for foam rubber Aliphats 44-A and 44-B; for dense rubber Aliphats 6-R and 7-R. For technical data, please mail the coupon below.

☆☆☆☆☆

The motto of General Mills research laboratories is "Progress Thru Research." We like to think this motto explains much of the success of General Mills as a vigorous and expanding manufacturer of foods, feeds, household appliances, and chemical products for industry.

General Mills has developed and improved a wide variety of industrial fatty acids. These General Mills Aliphats have a record of successful performance in many industries—rubber, paper, mining, lubricants, waxes and polishes, cosmetics, protective coating, soaps, insecticides, detergents, and others.

If you do not have technical information on the fatty acids available from General Mills, just mail the coupon below.

There is an ALIPHAT for your specific need.

☆☆☆☆☆

Controlled distillation processes used by General Mills guarantee that manufacturers will receive fatty acids of high quality and uniformity.

General Mills Aliphat 44-B, for example, is an unsaturated fatty acid produced from tall oil. Its outstanding properties permit the use of Aliphat 44-B in a number of industrial applications—liquid and jell type soaps, latex foam rubber, synthetic oils, ore flotation, special polishes, and carbon paper. These and other uses illustrate the adaptability of Aliphat 44-B. It seems to have a possible application wherever unsaturated acids with a low titer are required.

Aliphat 6-C, on the other hand, is a saturated acid of excellent quality. It has good stability and will perform effectively and economically wherever lighter color is not required. This Aliphat has a saturated acid ratio of approximately 60 per cent palmitic acid and 40 per cent stearic acid. Besides its recommended use in sponge rubber, Aliphat 6-C has proved very useful in metallic soaps, buffing compounds, and emulsifiers.

☆☆☆☆☆

General Mills

CHEMICAL DIVISION

KANKAKEE, ILLINOIS

Please send me technical information on General Mills Aliphats (fatty acids).

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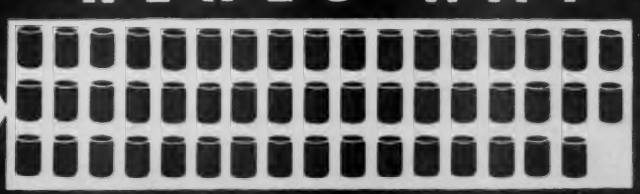

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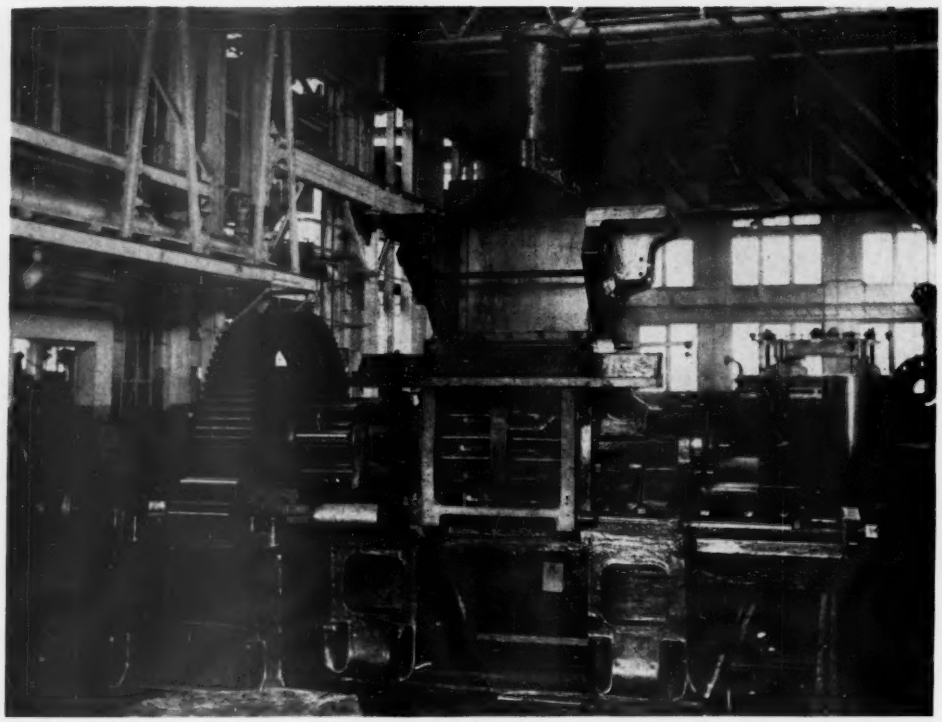

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When your Banbury Mixer needs repair or rebuilding, give us a call. It will cost you nothing to have an estimate. One of our engineers will visit your plant and inspect your installation at your request.

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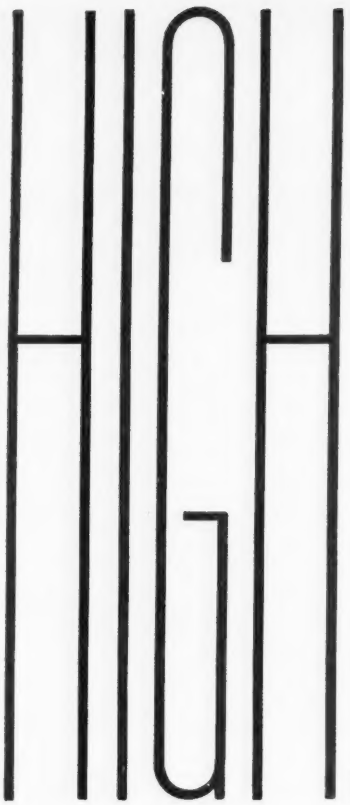

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VOLUME 74
NUMBER 4

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* Appears every other month

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Published on the 15th of each month by

PALMERTON PUBLISHING COMPANY, INC.

Printing Office,
East Stroudsburg, Pa.

Editorial and Advertising Offices,
250 West 57th St., New York 19, N. Y.

New England Representative—F. ROYAL CAREY, P.O. Box 133, Providence, R.I.

Midwestern Representative—JOHN P. O'KEEFE, 549 West Washington St., Chicago 6, Ill. Phone: Central 6-0545

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Entered as Second Class Matter, October 20, 1933, at the Post Office at East Stroudsburg, Pa., under Act of March 3, 1879. Subscription Rates: Domestic, $5.00 a year; Canada, $5.50; Foreign, $6.00. Single copies up to 3 months old, 50 cents; over 3 months old, 75 cents. Telephones: COlumbus 5-2923, 5-2924.

Contents Copyrighted 1954 by the Palmerton Publishing Company, Inc.

Indexed in Industrial Arts Index and Engineering Index. OFFICERS: P. L. Palmerton, President; E. D. Osborn, Vice-President and Secretary; Peter P. Pinto, Treasurer.

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RUBBER AGE

Vol. 74, No. 4 JANUARY, 1954

Rubber-Resin Blends

A Panel Discussion Held at the October 23, 1953, Meeting of the Akron Rubber Group

THE Akron Rubber Group, in a joint meeting with the Cleveland-Akron Section of the Society of Plastics Engineers on October 23, 1953, at the Mayflower Hotel in Akron, Ohio, held an interesting panel discussion on "Rubber Resin Blends". Moderator for the symposium was Dr. Frederick W. Stavely (Firestone). Panel members, all of whom delivered talks, included R. C. Bascom (Goodrich Chemical), W. D. Crater (Naugatuck Chemical), C. R. Holt (Marbon), Harold S. Sell (Goodyear), Walter J. Smith (Firestone), and Dr. A. J. Urbanic (General Tire). Mr. Bascom chose as his subject "Phenolic Resins with Rubber," while Mr. Crater concerned himself with "Styrene-Acrylonitrile Resins with Rubber". Mr. Holt spoke on "Styrene-Butadiene Resins with Rubber—Rigid," and Mr. Sell covered "Styrene-Butadiene Resins with Rubber—Non-Rigid". Mr. Smith chose as his topic "Polyvinyl Chloride with Rubber," and Dr. Urbanic discussed "Other Blends—Present and Future". Following the talks, a question-and-answer period was held. The talks presented at the meeting, as well as the questions asked and the answers given, follow:

Blends of Phenolic Resins with Rubber

By R. C. BASCOM

B. F. Goodrich Chemical Co., Cleveland, Ohio

MY assignment today is blends of phenolic resins with rubbers and in this short introduction I propose to discuss the characteristics, preparation, methods of processing and applications of such blends in a very general way. In the question-and-answer period which follows more discussion will be given to specific problems.

Phenolic resins are the products of a condensation reaction between aldehydes, usually formaldehyde, and phenols. Phenols commonly used are normal phenol, cresol and specially modified phenols. When a phenol and an aldehyde are reacted together, and the reaction is permitted to go to completion, a hard strong resinous material is produced. If, however, the reaction is stopped short of completion, the resinous product may be of any desired molecular weight and physical state. The product may be a liquid or a solid, but is usually thermoplastic. The reaction may be stopped by interrupting its course or it may be stopped by using a lower amount of formaldehyde than would be required to complete the reaction to a hard resinous product.

The product of this second type of reaction is the common type of phenolic resin used in the industry. In order to use this particular product it is necessary to add an activator, usually in the form of hexamethylene tetramine, which reacts with the partially converted resinous material to form a complex mass polymer with a great deal of strength.

Fillers and lubricants are usually added at the same

time that the "hexa" is added to this resin. This is done by dry blending the powdered resin with the other ingredients, followed by a hot milling operation which serves two purposes: one, the resin is fluxed to form a continuous phase of resin around the filler particles, and, two, the resin-"hexa" reaction is started and the resin is advanced towards its final cure.

I have gone into detail on this operation because, although it is well known, many people tend to forget that the resin reaction is irreversible and progressive. That is, each time the resin is heated it advances towards its final cure. Compounders who are used to processing rubber are sometimes surprised by the scorchy nature of phenolic blends.

Compatability of Nitrile Rubbers

Because molded parts made with the phenolic resin are inherently brittle and yet very strong, consumers and manufacturers of phenolic resins and manufacturers of rubber parts have been trying to make combinations of rubbers and phenolic resins for a long time. Phenolic resins and most rubbers are inherently not compatible. However, the advent of nitrile rubbers which are inherently compatible made practical useful blends of rubbers and resins.

Most phenolic resins have a degree of compatibility with all nitrile type rubbers. This compatibility is especially evident in the uncured state and such blends made on a rubber mill show a nice uniform smooth rolling bank and a translucent sheet. However, this very wide range of compatibility seems to be limited to the uncured state and there is considerable interference with the cure or condensation reaction of the phenolic resin. Accordingly, the most useful cured blends of phenolic resins and nitrile rubbers are made with highly modified resins which are available from nearly all of the major phenolic resin manufacturers and nitrile rubbers with acrylonitrile content on the order of 40%. With these limitations, useful blends of nitrile rubbers and phenolic resins can be made over the whole range. Relatively small amounts of phenolic resin will reinforce the rubber to give a tough cured sheet without supplementary filler or vulcanizing agents, while a small amount of rubber will reduce the brittleness of the phenolic resin and produces a product which is quite tough.

The physical properties of such blends are nearly as one would expect. The rubber increases elongation and impact strength of the phenolic resins while it lowers hardness and tensile strength. The resin, on the other hand, increases the tensile strength and hardness and in general reinforces the rubber. Although special resins and rubbers are required to get a wide range of compatibility, certain applications can tolerate blends with less compatability. For instance, a highly modified resin will reinforce shoe soles when GR-S is used even though there is not good compatibility in this particular case, and small amounts of nitrile rubbers can be used to modify even conventional phenolic resins.

A discussion of preparation and processing of these blends must be broken down into the type of end application or industry. When these blends are used as adhesives, they may be blended in aqueous media solvent solution or as adhesive film; for instance, the resorcinol formaldehyde latex type of adhesive for tire cord. Nitrile latex is very often blended with phenolic resins in dispersion to produce an adhesive useful for flocking cement, wood glues and for other high strength adhesive applications. In aqueous blends it is important that the phenolic resin be a dispersion rather than a solution because free alcohols or phenols usually present in the phenolic solution cause the nitrile latex to coagulate. Blends of nitrile latex and phenolic resin are sometimes incorporated in wet process addition in paper for lamination into sheet material.

Solvent solutions for use as adhesives are prepared by adding soluble phenolic resins to solutions of nitrile rubber compounds. Adhesive film for use in bonding automotive brake shoes to bands are prepared by calendering suitable dry, mixed blends of rubber and resin. The film has thermoplastic adhesive qualities and strong bonds are obtained by curing an assembly under pressure.

In the rubber industry when phenolic resins are used to reinforce nitrile rubbers, the resin is added as part of the filler in the conventional method of mixing for rubber products. The resin produces an uncured rubber compound which is rather difficult to manage. It is thermoplastic, very boardy and rather stiff; when it is hot it tends to stick and it tends to be rather scorchy.

When a small amount of nitrile rubber is used to modify a phenolic molding compound, the rubber is added in the conventional phenolic mixing cycle as a powder to the powdered resin and fillers. The resultant powder mix is fluxed on a mill for a very short time and then granulated. Although these operations are performed on conventional machinery for each industry, problems are introduced which were at first very troublesome. The resulting uncured compound is considerably tougher and stronger than the conventional phenolic mix. The problem of granulation of this mix is considerably more difficult than the granulation of a conventional phenolic molding compound. The rubber modified phenolic resin molding compound usually cured a little slower than the conventional phenolic and in most cases has considerably more flow. However, because of the unusual characteristics of blends of phenolic resins and nitrile rubbers, difficulties in processing are overcome and such blends are in rather wide use.

Applications of these blends cover such a broad industrial scope that it is impossible to cover them all. Accordingly, I will only mention a very few. First is the use of phenolic resin to modify nitrile rubber in shoe holders for a sole cementing machine. This piece made from tire cord filled natural rubber compound will completely wear out after six weeks of use. The same piece made from a phenolic resin modified nitrile rubber will be in excellent condition and still serviceable after 1½ years of wear.

Highly Modified Phenolic Resins

I previously mentioned the use of a highly modified phenolic resin to supplement high styrene resins in reinforcement of shoe sole compounds. This resin is useful in such compounds because it produces a more rigid, less thermoplastic shoe sole which has excellent resistance to deformation at a slight sacrifice in flex life. Such a shoe sole modified with a combination of phenolic resin and high styrene resin is useful on inexpensive women's shoes where inadequate filling is placed between the uppers and the mid sole. A normal high quality styrene resin-reinforced shoe sole will tend to deform in operation and show ridges caused by poor shoe manufacture. The more rigid phenolic-reinforced sole on the other hand will bridge over these ridges and retain a smooth surface.

Adhesives made from nitrile rubbers and phenolic resins are useful in a great many applications. They adhere well to almost all materials except polyethylene, Butyl and natural rubber. They are used for such high strength applications as the adhesion of brake bands to brake shoes for automotive brakes and for the adhesion

of shoe soles to uppers in the manufacture of shoes, and, of course, they have a whole wide range of applications in between these two extremes.

Harder molded parts made usually in phenolic molding plants utilize relatively small amounts of nitrile rubber to produce products which are hard, yet tough, strong and yet not brittle. Parts made from these compounds are used for three major reasons: First, thin sheets of the material can be cured and parts can be punched from the sheets without fracture; second, large and complicated inserts can be molded into a part without danger of cracking from thermal expansion or contraction; third, high impact strength can be achieved using fillers which are normally considered to be of low impact strength in conventional compounds.

Thus, a wood flour or asbestos-loaded nitrile rubber phenolic compound would have the impact strength of a flock or fabric filled material. This is a decided advantage since larger sized filling materials in phenolic molding compounds increase the cost and difficulty of molding by a great deal; further, cellulosic materials used as filling for phenolic compounds tend to have relatively poor water resistance and correspondingly poor electrical properties. The use of mineral filled nitrile rubber modified phenolic molding compounds permits manufacture of parts which have exceptionally good electrical properties and physical properties.

In conclusion, I would like to point out that these blends offer compounding tools to both the rubber compounder and to the phenolic resin compounder. They permit the use of phenolic resins in applications where conventional phenolic molding compounds could not be used, and thus expand the market for both the nitrile rubber and the phenolic resins. These blends were created because there was a definite need for compounds with the physical properties made possible by the blends and we are quite sure that future blends will be created as the necessity for them develops.

Blends of Styrene-Acrylonitrile Resins with Rubbers

By WILLARD DE CAMP CRATER

Naugatuck Chemical Division, U. S. Rubber Co., Naugatuck, Conn.

THE plastics industry, although far from new, like its big brother rubber, is growing up very fast. The Paley Report, based on studies made by Standard Oil, Stanford Research, the National Production Authority, and others, shows a growth rate from 2.4 billion pounds in 1950 to over 22 billion pounds by 1975 for all plastics. A large percentage of this increase is predicated on the present and the development of new resin and rubber blends with improved characteristics.

Styrene monomer, thanks in part to the synthetic rubber industry, is available at a reasonable price. Polystyrene has a combination of valuable properties and has had a very fast growth rate since 1944. Its deficiencies include brittleness and relatively low softening temperature. To overcome these undesirable properties, other monomers such as acrylonitrile, used in the manufacture of oil-resistant synthetic rubber, were chosen for copolymerization with styrene. These copolymers have found commercial use and have better solvent resistance, heat distortion and impact than polystyrene. However, these polymers lack the toughness on high impact desirable for many applications.

Combinations of styrene-acrylonitrile resins and butadiene-acrylonitrile rubbers provide a marked increase in toughness with little sacrifice in hardness and heat distortion of the unmodified resins. Of the various rubbers evaluated with the styrene-acrylonitrile resin, butadiene-acrylonitrile has established the desirability of this particular blend.

The ratio of nitrile in the resin-rubber and the ratio of the resin to rubber in the final mixture are but primary variations, and a multitude of secondary variations can be imposed on this already flexible system. Although the system appears simple, in reality it is complex. To obtain both desirable and maximum mechanical characteristics it has been found necessary to tailor make the individual resins and rubbers used in the blends. The series of available molding and extrusion compounds feature: (1) Toughness and good rigidity, (2) Dimensional stability, (3) Decorativeness and functionality, (4) Easy formability, (5) Chemical and strain resistance, (6) Good electrical properties, (7) Low specific gravity, and (8) Versatility.

To be more specific, individual blends with high hardness exhibit notched Izod impact strengths of 8 ft. lbs./in., with a corresponding value of about 40 ft. lbs./in. for the unnotched Charpy impact at room temperature. New relatively hard blends retain toughness with virtually no loss down to —40°F. and with only a moderate decrease at temperatures down to —60°F. This new material seems unique since the impact values over the entire temperature range are appreciably higher than for other available thermoplastics of equivalent hardness and rigidity. The Izod impact values are between 6 and 7 ft. lbs./in. from —40° to 90°F. and are still above 4 ft. lbs./in. at —60°F.

Since it is not necessary to use monomeric plasticizers in the resin-rubber blends, they exhibit excellent dimensional stability at high humidities and at low and high temperatures. As would be expected, the resistance to oils, fats, chemicals, and gasoline is good. The bursting strength frequently correlated with so-called effective tensile strength is superior to many other plastics. This combination of properties is extremely useful for such end products as pipe handling many types of corrosive materials.

One disadvantage is the fact that the blends are opaque and cannot be used where transparency is required. However, a full range of colors can be obtained for most applications.

Preparation of the molding powders based on the styrene-acrylonitrile and butadiene-acrylonitrile blends has been accomplished in conventional and special mixing equipment. The process may start with latex blending or coprecipitation. As previously stated, in addition to the selection of the proper grades of resin and rubber, control of mixing (temperatures, cycles and method of addition) is very important to achieve the maximum properties of the blends. Impact, for example, can be drastically affected by mixing, and years of factory experimentation were required to achieve the quality of molding powder now sold.

The blends are processed into numerous products by calendering, molding, and extrusion. The fact that these

blends do not have a sharp or critical softening point in many applications is a distinct advantage. For example, in the processing of large diameter pipe it is much easier to control dimensions and the cooling and sizing equipment can be simplified.

Applications for the blends or the plastalloys, as they are frequently called, include golf club heads, molded helmets, carrying cases, molded cams, gears, pipe, pipe fittings, chair parts, door knobs, shower and spray nozzles, floats, valve parts, machine housings, and small machinery parts replacing metals, molded caps, bobbins, spools, quills, automotive applications, duct work, and foamed parts.

In summation, thermoplastics obtained from styrene-acrylonitrile resin and butadiene-acrylonitrile blends have high impact strength combined with good hardness and rigidity. The discussion has been limited to a single system which gives a high order of toughness and includes a compound with excellent low temperature properties, but the same principles should apply to other resin-rubber systems. Both suppliers and molders are evidencing growing interest in such combinations, which promises that future developments in rigid thermoplastics will include wider use of resin-rubber blends.

Blends of Styrene-Butadiene Resins with Rubbers—Rigid Compounds

By C. R. HOLT

Marbon Corporation, Gary, Ind.

THE uncompounded styrene-butadiene resins are not especially useful as end-product materials. Their value is entirely in their use as compounding resins with the various rubbers, with the resin used as a modifier and reinforcing agent for the rubber, or with the rubber used in small amounts to modify the basic properties of the resin. This latter type of compound, where the resin is 60% or more of the total resin-rubber content, is usually rigid or semi-rigid and is the kind of blend which will be discussed here.

The general characteristics of these materials include excellent impact strength, high tensile and hardness, good electrical properties, low specific gravity, bright colors and good low-temperature properties. Practically all machining operations, such as sawing, drilling, buffing and sanding, can be readily performed. Resistance to inorganic chemicals can normally be considered very good. The following values are typical:

Tensile	3000- 6500
Elongation, %	100- 1
Shore D	60- 80
Impact, notched Izod	100- 10
Specific Gravity	1.00- 1.15
Flexural Strength	6-12000
Heat Distortion, °F.	105-175° F.
Brittle Point, °F.	—40- —60

Since these are blends of slightly unsaturated resins and somewhat more unsaturated rubbers, they are vulcanizable and must be cured to obtain the optimum physical characteristics. Cure time and temperature are dependent upon the curing ingredients used. Uncured blends are of little practical significance. In appearance they resemble the cured compound but do not have the tensile or flexural strength of the cured stock.

Each compound is naturally made to fit the requirements of the particular end-use. Physical properties are controlled by the type and amount of plasticizer and filler, the softening point of the resin, and the sulfur content.

The high styrene resins can be plasticized with a number of types of rubber plasticizers, such as certain esters, chlorinated materials, coumarone-indene resins, etc., but natural and synthetic rubbers are by far the most interesting. GR-S and the high nitrile rubbers are especially compatible; natural rubber and neoprene are also very good. GR-I does not seem to be compatible.

The most outstanding property of these blends is their high impact strength. Small amounts of rubber (10 to 20%) give excellent impact strength with only minor sacrifices in hardness and other properties. Increasing the elastomer content continues to increase impact resistance, but gradually lowers hardness, tensile and modulus to the point of a leatherlike rather than a rigid compound.

The nature of the rubber used should be considered for several factors; the low-temperature brittle point of the vulcanized blend seems to be dependent upon the freeze point of the rubber and is apparently independent of the amount of rubber present.

Polybutadiene is an excellent plasticizing rubber for good low-temperature properties although natural rubber and GR-S will give brittle points of —40 to —60°F. Stocks designed for oil resistance would naturally call for neoprene or Buna N as the modifying rubber. Electrical molding compounds would call for the proper grade of GR-S or natural rubber in order to maintain the excellent electrical properties of the styrene-butadiene resin.

Reinforcing pigments such as the carbon blacks are not generally used, although up to 75 parts of an SRF or furnace black will improve tensile and compressive strength properties.

Non-black fillers do not reinforce these blends and should be used only for cost reduction or processing advantages. For removal of a piece from a hot mold, for example, some loading is advisable to reduce shrinkage and to facilitate handling. Cotton or cellulose flock, long-fiber asbestos and wood flour are good in this respect. Diatomaceous silica is excellent for loading compounds designed for chemical resistance. For reducing cost, whiting and clay or the soft blacks may be used. Practical rigid compounds with an Izod impact value of nearly one pound may contain as much as 200 parts of clay on a 50-50 blend of resin and rubber.

None of these compounds have a sharp melting point. They will soften to a plastic condition at temperatures of 130 to 200°F., depending upon the softening point of the resin and the sulfur content of the blend. Increasing sulfur, up to 12 to 15 parts, will increase the hardness and the heat distortion temperature at the expense of impact strength and darker color. Of two stocks equal in hardness and modulus, the one higher in resin and lower in sulfur will usually have the higher impact strength.

A similar use of high sulfur with blends of styrene-butadiene resins and rubbers is in the compounding of ebonite or hard rubber. Replacement of part of the

rubber with the resin permits the use of less sulfur with consequent lighter color, reduced cure time, and increased impact resistance and softening point. Thick sections can be cured in less time without porosity or blowing.

It has been mentioned that vulcanization is necessary to bring out the full properties of these blends but there are several exceptions to this, i.e., combinations of styrene-butadiene resin and Neoprene S are very tough and will show tensiles as high as 4000 lbs. per square inch in the uncured state. Another modified high styrene resin with a high softening point is very compatible with the various synthetic rubbers and uncured blends show excellent impact strength values with high heat distortion temperatures and low brittle points.

The mixing and processing of these blends is much the same as that of conventional curing compounds and any conventional rubber equipment can be used. Average mixing temperature will be 200 to 225°F. to permit softening and fluxing of the resin with the rubber. One special precaution must be taken in the handling of the mixed compound—the uncured stock is usually very hard or even brittle and preheating of the stock blanks before molding is necessary in most cases. A satisfactory method for curing in positive or semi-positive molds is to granulate the uncured stock and load the mold with a weighed charge of granules.

For calendering sheet blanks, the raw stock can be preheated prior to placing it on the warmer mill or the granulated compound can be charged directly onto the warmer. The calendered stock is then usually plied-up in the mold and press polished into sheets for post-forming operations.

As mentioned, cured compounds are very flexible when hot and must be cooled before they can be handled. Larger pieces are best cooled on forms which allow dimensions to be accurately maintained. Smaller articles can simply be air- or water-cooled. Some types of molded items can be cured flat and later reheated and shaped over forms. A cured resin-rubber blend is too thermoelastic, however, to be remolded into an entirely different shape where the stock must flow in the mold.

Typical applications for these blends include athletic and crash helmets which give protection to the wearer, are light in weight, colorful, and do not absorb moisture. Desk pads and automotive door pads can be made scratch resistant and in bright colors. Shipping containers for pharmaceuticals are strong and light; pipe-fittings, acid containers and vent ducts all illustrate the good chemical resistance of these cured blends.

An appropriate balance of rubber, sulfur and filler content can usually be made to meet most hardness, impact, cost, heat distortion and processing requirements.

Blends of Styrene-Butadiene Resins with Rubbers—Non-Rigid Compounds

By HAROLD S. SELL

Goodyear Tire & Rubber Co., Akron, Ohio

STYRENE-BUTADIENE copolymer resins have gained widespread acceptance as rubber compounding ingredients since their first introduction to the trade following World War II. These copolymer resins, containing 80 to 90% styrene in combination with butadiene, are hard, clear, brittle resins and of very limited value as resins themselves. However, they are compatible with natural rubber, GR-S, and nitrile rubbers and impart desirable properties to be enumerated later in the discussion. They are of limited compatibility and use with chloroprene rubbers and incompatible with the Butyl rubbers.

The properties imparted by the incorporation of high styrene copolymer resin into rubber are as follows:

1. They increase hardness.
2. They increase stiffness.
3. They improve the poor gum properties of synthetic polymers; specifically, tensile strength, elongation, and tear strength.
4. They improve abrasion resistance.
5. They promote good hot tear strength.
6. They improve the electrical properties of any rubber into which they are incorporated.
7. They do not materially alter the brittle point of the rubber into which they are incorporated.
8. They are excellent aging materials and their incorporation improves the aging of natural rubber.

In addition to the improvements in physical properties, they serve several other useful functions in the compound. Among these are:

1. They are the lowest specific gravity, non-discoloring and non-staining reinforcing materials available.
2. They kill the nerve and reduce the shrinkage of the batch.
3. They act as plasticizers and processing aids at stock processing temperatures.

Incorporation of the resins into the rubber batch is readily accomplished on conventional rubber equipment. Commercial resins have been developed which disperse upon direct addition in the Banbury or when incorporated directly into the stock on a warm mill. In most cases the resin will disperse while the pigment is being incorporated into the batch. In some cases, where short, cool mixing cycles are desired, some manufacturers find it desirable to premasterbatch the resin and rubber on hot equipment and use the masterbatch form on a cold mill.

All existing applications for high styrene reinforcing resins are based upon one or more of the features imparted by the resin, as outlined earlier. A few examples will serve to illustrate this point.

Synthetic leather-type shoe soles consume the greatest volume of resin and utilize the largest number of features imparted by the resin. Their high hardness, while maintaining light color and low specific gravity, the stiff "leatherlike" feel, the high tear, the good abrasion resistance of the soles, and the easy processing characteristics of the stock are all obtainable by resin reinforcement.

The wire and cable trade use the resin for its excellent electrical properties, GR-S reinforcement, and aid in rapid, smooth extrusions.

Flooring manufacturers utilize the resin to maintain a high level of hardness, aid processing of the highly loaded stocks, and maintain hot tear to minimize tearing upon stripping from the mold.

Manufacturers of molded items use the resin for a variety of reasons from its aid in processing and extruding preforms to improve tear strength and control specific gravity.

Recent work indicates that improved hard rubber can be made by obtaining some of the hardness and stiffness

from high styrene resin either at the same or reduced sulfur levels. The resin addition, because of the dilution effect and the inherent unsaturation of the resin, has a tremendous suppressing effect on the exothermic sulfur reaction.

High styrene resin can be used as a partial substitution for balata in many applications such as golf ball covers.

There is evidence that high styrene resin assists in obtaining uniformity of blow in such articles as internally blown sponge or soling.

Applications for the resins in the flexible stock field have grown steadily as new ways have been found to utilize the unique properties imparted by resin reinforcement. Their properties challenge investigation.

Blends of Polyvinyl Chloride with Rubbers

By WALTER J. SMITH
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POLYVINYL chloride resins may be compounded and fluxed to yield end-products ranging from hard, rigid, brittle items to soft, flexible tough ones. The great bulk of applications for these resins to date has required products with some degree of flexibility and toughness. While rubbers can be used in small amounts in rigid products, this discussion will deal primarily with the modification of polyvinyl chloride into more flexible items partially or wholly through the addition of elastomers.

The acrylonitrile-butadiene copolymers, or N-rubbers, are by far the most commonly used elastomers for plasticizing or softening of polyvinyl chloride polymers and copolymers. These N-rubbers can be prepared with varying amounts of acrylonitrile, with different Mooney viscosities, with different modifiers, and in varying physical form. All of these variations can have a large bearing on the ease of processing of the resin-rubber mixture and on the resultant physical properties.

Polyvinyl chloride may be plasticized exclusively with the nitrile rubber, or, as is more common, with a mixture of the N-rubber and liquid plasticizers. In general, N-rubbers with medium acrylonitrile content, in the range of 30 to 37%, are the most useful for plasticization of the vinyl chloride resins. Rubbers with both higher and lower acrylonitrile contents, however, are compatible with polyvinyl chloride resins and are used where they can contribute to specific end properties.

N-Rubber plasticized vinyl chloride resins are characterized by excellent retention of flexibility and impact resistance after prolonged or repeated contact with oils, greases and aliphatic hydrocarbons in general, or prolonged exposures to elevated temperatures. This quality of being able to retain flexibility and impact strength after exposure to conditions which cause normally plasticized vinyl chloride resins to become stiff and brittle makes these blends very useful in many troublesome applications.

Among the less desirable characteristics of vinyl chloride resin compositions plasticized with nitrile rubbers have been the relatively poor resistance to light aging, the low plasticizing efficiency of the N-rubber as compared with the efficiency of most liquid plasticizers, and the processing problems which have been encountered. Proper stabilization of the vinyl resin and the rubber will improve aging and reduce processing problems. Use of a liquid plasticizer chosen for its effect on the rubber rather than the resin will aid processing of the mixture and will give added smoothness of surface to calendered or extruded products.

Tensile strength of N-rubber and vinyl chloride resin blends is usually lower than vinyl chloride resin plasticized to equivalent hardness with liquid plasticizers such as D.O.P. In very flexible calendered sheets, or extruded sections, blocking becomes more of a problem with the N-rubber plasticized compositions than with the liquid plasticizer mixes. Both of these properties can be improved, and greater resiliency and abrasion resistance can be obtained by vulcanizing the vinyl resin-nitrile rubber blend. Mercaptobenzothiazole and benzothiazyl disulfide are satisfactory accelerators of vulcanization. Such cured stocks are no longer thermoplastic to the point of reworking, but they can be postformed into useful articles after heating. Blocking of mixtures containing high percentages of nitrile rubber may also be reduced by use of lubricants such as Acrawax C or paraffin wax.

The effect of some variations in preparation of the N-rubbers on physical properties of the polyvinyl chloride-N-rubber blends may be summarized in a very general way as follows: (1) As the acrylonitrile content is increased, grease and oil resistance is improved, tensile strength increases, processability is easier, product surface is smoother, low temperature impact is poorer, resilience decreases, and blocking is reduced; (2) As the Mooney viscosity is increased, processability is poorer, product surface has a rougher appearance, low temperature impact is better, and blocking is again reduced.

In addition to the nitrile rubbers, polyvinyl chloride resin compositions have also been modified with other rubbers such as GR-S, polyisobutylene, and substituted acrylonitrile-butadiene copolymers. Many interesting variations in toughness, hardness, impact resistance, abrasion and chemical resistance can be obtained by modification of polyvinyl chloride polymers and copolymers with these individual rubbers or with combinations thereof.

Polyvinyl chloride and rubber mixtures are generally prepared by one of the following methods:

1. In one method, a pre-blend of the vinyl chloride resin, stabilizer, lubricant, fillers, liquid plasticizers, and color is made and fluxed on a hot mill (270 to 350°F) or in a Banbury mixer (280 to 340°F). The rubber is then added to the fluxed resin blend.

2. In a second method, the rubber is pre-masticated on a cold or hot mill, or in a Banbury mixer before being added to the vinyl resin blend as above.

3. In a third method, the rubber is pre-masticated on a cold mill and the vinyl resin and other compounding ingredients are added to the rubber as a filler while milling. The batch is later fluxed on a hot mill or in a Banbury.

4. In another method, the rubber is pre-masticated in the Banbury mixer and the vinyl resin pre-blend or individual ingredients are added thereto. The whole batch is fluxed at temperatures of 270 to 350°F.

5. In still another method, a powdered, or fine crumb, form of the rubber is preblended with the vinyl chloride resin and other compounding ingredients in a ribbon

blender or other type premixer. The batch is subsequently fluxed on a hot mill or in a Banbury mixer.

6. In the final method, a homogeneous mixture of the rubber and resin is prepared by co-coagulation or co-precipitation of blended latices or slurries of each. Other compounding ingredients are added to the resultant blend on either a hot or cold mill, or in a Banbury mixer.

The method of preparation to be used depends on the rubber content of the final stock, the permissible mixing time, the ease of processing required, and the desired smoothness of surface of the finished product.

Where the rubber is only a minor portion of the total mix, the compound is usually mixed in the same fashion as an ordinary vinyl chloride resin stock, but pre-mastication of the rubber will result in easier processing and a smoother surfaced finished item.

Where the rubber accounts for a substantial part of the total mix, good processing and a smooth surfaced finished product are obtained by intimate mixing of the vinyl chloride resin and the rubber prior to fluxing of the blend. This is most satisfactorily accomplished by the co-coagulation or co-precipitation method. Nerviness of N-rubbers, which is particularly noticeable in mill mixing, is thus largely eliminated.

Another method of improving processing and surface appearance of vinyl chloride resin and N-rubber products is to break down the rubber on a cold mill in conjunction with the addition of approximately an equal amount of calcined clay. Still another method is the hot milling or Banburying of the rubber to the point where its Mooney viscosity has reached the second minimum. This latter result can also be duplicated by special polymerization techniques through which the N-rubber is partially cross-linked with divinyl benzene.

It is always necessary to flux the vinyl resin, at some point in the process, to obtain its maximum contribution to the properties of the mixture. This is done by raising the mix to a temperature of from 270 to 360°F., depending upon the type of vinyl chloride resin and the particular compound used.

Calendering of polyvinyl chloride-rubber blends is carried out in essentially the same way as straight polyvinyl chloride-liquid plasticizer compositions. The success of the calendering operation and the appearance of the finished sheet or film depend very much on the processability of the rubber, particularly as the percentage of rubber in the mixture is increased. Choice of Mooney value, acrylonitrile content, and physical form should be such as to give minimum nerve and graininess under the conditions of processing required to obtain the desired physical properties.

Strength properties of vinyl chloride and N-rubber blends are primarily dependent on the degree of fusion of the vinyl chloride resin. Higher milling and calendering temperatures (up to 360°F.) will result in better tensile strength, provided both the vinyl chloride resin and the N-rubber are adequately heat stabilized. Agerite Stalite, Deenax, and Ionol are useful stabilizers for retarding oxidation of the rubber during processing, while a variety of lead compounds, the barium, cadmium laurate-epoxy resin combinations, and some tin compounds will prevent heat decomposition of the vinyl.

Processors of films of .010-inch and thinner must take special precautions in calendering vinyl chloride-N-rubber blends. At such small roll openings, and at processing speeds usually used for thin films, the heat build-up in the calender banks is much greater in stocks with high rubber content than with liquid plasticized compositions of similar flexibility. Double, or even triple, the normal quantities of the most effective vinyl chloride resin heat stabilizers may be required. Added amounts of lubricant may also be required to obtain smooth and even release from the calender rolls, as well as to avoid blocking in the roll of finished film after storage. These problems are less troublesome with heavier gauge films and sheetings, and as the rubber content of the stock decreases.

Extruders of polyvinyl chloride resin and rubber blends have a choice of feeding a fluxed resin compound or a compounded rubber to the extruder. The type of pre-mixing equipment available usually determines this choice, although it is desirable to provide as little heat history as possible for both resin and rubber prior to the extrusion. In either case, the extrusion temperatures must be such as to completely flux the vinyl chloride resin if optimum physical properties are desired. Temperatures of from 300° to 360°F. are usually adequate.

Polyvinyl chloride resin and N-rubber blends have also been made into very thin cast films which can be cured during the drying operation. Such films are very interesting as packaging materials, having excellent grease and oil resistance, good clarity, high tear and tensile strength, and, with suitable compounding, good resistance to moisture vapor transmission. Complete solubility of the rubber in the resin solvents is necessary for best results from such mixtures, as well as some of the other characteristics which are needed for an N-rubber that will calender well with vinyl chloride resin.

Polyvinyl chloride resin and N-rubber blends are used in the following applications: (1) Jacket insulation on coaxial cable over polyethylene primary insulation, (2) As primary insulation on low voltage appliance wires, (3) Upholstery sheeting, (4) Extruded shoe welting and shoe uppers, (5) Thermoplastic tubing for beverages, gasoline, oil, solvents, and industrial chemicals, (6) Hospital sheeting and industrial aprons, (7) Packaging films, (8) Camera case coverings, motorcycle seat covers, and binocular containers, (9) Cured compounds for printing roll covers, gaskets, valve disks, etc.

Resin-Rubber Rigid Blends—A Summary

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WHEN small portions of a specified rubber are added to a resin, we obtain certain advantages as well as other changes that may be regarded as disadvantages. The usual, and of course, important advantage of adding a rubber to a resin is an improvement in toughness—the impact strength is raised both at room temperature and below. The rubber increases the flexibility and elongation of the resin so that a sudden force on the plastic is more easily dissipated without fracture. Most often twenty or more parts of rubber must be added to a brittle resin to get the desired degree of useful toughness, and the more rubber that is added the greater is the im-

provement. Other advantages which are minor, but important at times, are the improvement in the hot tear strength and the lowering of the processing temperature. The former is important in both extrusion and calendering. Much difficulty is experienced with synchronizing take-off equipment with an extruder or calender with a poor hot tear strength material. The lowering of the processing temperature may be important if the resin tends to decompose or to depolymerize; otherwise, some porosity in the finished product may be had.

On the other hand, certain disadvantages result from the addition of the rubber portion. It is a give and take proposition. You just don't get anything for nothing. The heat distortion, hardness, and tensile strength are usually lowered, the amount increasing with an increase of rubber content. Likewise, the processing conditions are altered as the resulting blend has usually poorer flow properties than the resin itself. For instance, an injection pressure of 18,000 psi is needed for a rubber modified styrene blend on the market today, whereas 12,000 psi would be satisfactory for the resin itself. These poorer flow properties usually lead to longer injection cycles or to slower extrusion speeds. The weathering properties of the blend are also usually inferior to that of the resin and great care should be exercised in testing this property, especially the correlation of crazing and impact strength with time of weathering. (This is especially so if an outdoor end use for the blend is contemplated.) The staining brought about by the antioxidant present in the blend should also be checked. It may be said that an antioxidant which appears adequate for the rubber itself may not be satisfactory for the blend. This is so because higher processing temperatures are required for the latter.

Shrinkage of resin-rubber blends may also be different than for the resin itself, e.g., plain phenolic has a shrinkage of 0.008 inch/inch, whereas rubber phenolic blend has a shrinkage of 0.010 inch/inch. Thus, molds designed for the former, especially if close dimensional tolerances are wanted, cannot be used. Of course, the solvent resistance of a resin is also altered by incorporation of a rubber. Some of the drawbacks of resin-rubber blends mentioned above have been corrected, at least for certain blends. For instance, by replacing the usual commercial nitrile rubber with a high Mooney, very tight gel type in a styrene-acrylonitrile blend, the flow properties can be improved. Instead of a rough sheet off the calender, a smooth one is obtained by the modification.

What do we know about the rubber portion that forms a satisfactory resin-rubber rigid blend—will any rubber do or is the composition important? Yes, the composition is important. We know that a certain amount of compatibility must exist between the two phases to get a satisfactory product. For instance, GR-S has not been successfully combined with a standard type phenolic because of lack of compatibility. Therefore, nitrile rubbers are used with these standard phenolics because they are more compatible. On the other hand, a rubber that is too compatible may also be undesirable because of the marked effect on the heat distortion.

It may be honestly said that the art of resin-rubber blends is advancing more rapidly than the theory. For instance, even the necessity of the rubber portion in a blend has been questioned. Some results that have been reported lately seem to indicate that the toughness of a resin may also be improved by the addition of another resin. For instance, polyamide and polyvinyl acetate resins have been successfully mixed with epoxy resins to decrease the brittleness of the latter (so it is reported). Also, a recent patent tells of the improvement of low temperature impact strength of polyvinyl chloride with the addition of a styrene vinyl cyanide copolymer. However, it is the author's opinion that only a small improvement in toughness results on adding a resin as compared to the improvement in adding a rubber to a resin.

The author was asked to make a few comments on other resin-rubber blends not mentioned so far but which appear to have promising potential importance or which have been reported. Some of these follow:

Epon-Thiokol Systems: All of us know the excellent adhesive property of epons for adhering either polyester laminates to themselves, metal to metal or other rigid materials to themselves. However, these epons have been too brittle for adhering more flexible types of products. And the toughness of the epon bond has been improved by incorporation of a Thiokol rubber, specifically Thiokol LP-2. Twenty-five parts of the latter toughens the adhesive considerably.

Isobutylene-Styrene Copolymer Mixtures: These systems are analogous to the butadiene-styrene systems discussed by Messrs. Holt and Sell. The resins are high styrene-low isobutylene copolymers and the rubbers high isobutylene-low styrene copolymers. Because these systems are saturated they have better aging properties than their counterpart, the styrene-butadiene type.

Neoprene-New Styrene Blends: These blends give a tough, high heat distortion material which has a high impact resistance at as low as −20°C. These blends are not cured which of course is an advantage in the elimination of curing cycles and in the disposition of cured scrap.

Ethyl Cellulose-Rubber Blends: With natural rubber, 10 parts of ethyl cellulose gives a softer composition at the milling temperature and gives an increased elongation at break. With GR-S, ten parts of ethyl cellulose gives better dimensional stability and increased resistance to flex cut growth.

The most important methods of preparing resin-rubber rigid mixtures are as follows:

1. Banbury: The best method of mixing is in a Banbury especially if the resin tends to flow readily at the mixing temperature, e.g., phenolics.
2. Mill Mixing: This method is used but has certain limitations including cost.
3. Latex Mixing followed by Coagulation or Spray Drying: This method, of course, insures that the two phases are intimately mixed.
4. Ribbon Blending of Powdered Resin and Powdered Rubber: This method is limited now because of the problem of preparing suitable powdered rubbers economically. Also, it would be desirable to get powdered rubbers that can be easily vulcanized.
5. Ribbon Blending of Powdered Resin and Liquid Rubber: This method is also limited because of the difficulty of preparing liquid rubbers economically.

Other methods may be mentioned, such as the incorporation of rubber during polymerization or the incorporation of chopped rubber with the resin in the extruder.

In the past, the preparation of these blends has been done by their promoters, the raw material suppliers. However, as this field of resin-rubber rigid blends will expand, and it definitely will, the blending will be taken over by many of the fabricators themselves, especially the larger ones who will formulate their own blends in the same manner that they now formulate their own recipes. It is at this time when we shall see the greatest expansion of rubber-resin blends—a time when we shall see the further merging of rubber and plastic industries and a time when we shall see a further impact of this great combine on the automotive, appliance, machinery, and other industries.

Questions and Answers

Question—How does high styrene resin reinforcement compare with reinforcement with carbon black?

Answered by Mr. Sell: High styrene resin reinforcement compares most favorably with the SRF type black so far as hardness is concerned. In GR-S, both improve tensile and tear strength, but carbon black gives better resilience. High styrene resin cannot compete with carbon black on a straight reinforcement basis, but it can be used to augment carbon black where easier processing and flow is desired. High styrene resin reinforcement is generally used in non-black compounds.

Question—What are the aging characteristics of the styrene-butadiene resin and rubber blends? Is surface crazing a problem with rubber-resin blends?

Answered by Mr. Holt: Cured blends of high styrene resin and rubber can usually be considered to have very good aging properties. Normally, the rubber is replaced with the resin and since the resin, because of its lower unsaturation, has very good aging properties in its own right, the over-all aging characteristics of the blend are improved. Uncured blends on the other hand must be well protected with antioxidant and anti-checking wax. These blends tend to craze and veneer on weather aging especially.

Question—Should accelerators and age resistors be used in rubber-resin blends? If used, what types are most satisfactory?

Answered by Mr. Sell: Many of the rubber-resin blends are recommended for use uncured and consequently do not require acceleration. The styrene-butadiene resin types however are generally used vulcanized, and because of their similarity to GR-S in composition the normal GR-S type accelerations are applicable. It must be kept in mind that these resins contain unsaturation from the butadiene, which must be compensated for in the acceleration of the compound. Most commercially available styrene-butadiene reinforcing resins can be treated as containing about 20% the unsaturation of regular GR-S.

Most commercial resins and rubbers contain antioxidants to protect them during the drying operations and which may be adequate to protect the rubber-resin blend. The need for additional antioxidant and the type to be used will largely depend upon the service the blend will be subjected to and the color of the finished article. In general, it is the rubber component which must be protected, and to answer the question without going into the details of all the different types of antioxidants I would suggest that antioxidants used to protect rubber under the various service conditions be used as a guide in protecting the resin-rubber blends.

Question—Can good color stability be obtained in rubber-resin blends?

Answered by Mr. Holt: In the high styrene resin-rubber blends, color stability is usually no problem. The major factor, as in straight rubber compounding, is the discoloring effect of the antioxidant, and blends containing the best of the non-discoloring antioxidants are very resistant to light discoloration. The tendency of a blend to discolor from other causes depends on the over-all compounding of the material.

Question—Is it necessary to adjust cures in resin reinforced stocks due to the unsaturated butadiene portion of the resin? If so, how much?

Answered by Mr. Sell: If any quantity of styrene-butadiene resin is used, the unsaturation of the resin must be compensated for in the compound. As stated in reply to an earlier question, commercial high styrene reinforcing resins have about 20% the unsaturation of an equal quantity of GR-S.

Question—Comparing equal parts by weight, what resin is the most effective for blending with natural rubber to give a "hard rubber" stock?

Answered by Mr. Holt: The most suitable resins for hardening rubber compounds are the high styrenes and the phenolics. Due to the fact that phenolics cannot usually be considered compatible with natural rubber, and because of the lower specific gravity of the high styrene resins, on a weight for weight basis, the styrene resins are more efficient than the phenolics for this purpose. Cyclized rubber would very probably give about the same results as the high styrene resins.

Question—What, if any, is the difference in the final product between adding a resin to the rubber or vice versa? What is the reason for this difference (if any)?

Answered by Mr. Holt: In the case of high styrene resins, we see very little difference. In adding a rubber to the resin, the procedure is substantially longer and the rubber has a greater chance of being overmilled, with the possibility of lowered modulus and hardness. The difference can normally be considered minor, however.

Answered by Mr. Sell: So far as the high styrene reinforcing resins are concerned, we have found no difference in the physical character of the batch or its physical properties, provided the mixing is carried to complete dispersion. There is a danger when admixing the resin into the rubber of stopping short of complete dispersion, in which case the hardness and stiffness are obtained but the flexural properties are reduced. This is particularly true of resin-reinforced shoe soles where flex life suffers markedly. This danger is not present in admixing the rubber into the resin because too rapid addition of the rubber to the resin will chill the batch and crumble it from the mill before poor dispersion can result. I would suggest to the questioner, if he is mixing resin into rubber and has some question about ultimate dispersion,

that he sample a batch at different times of mixing and prepare test sheets. He will find that at some point in the milling the properties will attain fairly constant values. This is his optimum milling time.

Question—Durez 13355 disperses very easily and does a good job hardening GR-S with good retention of elongation and tensile in black stocks. Do you feel that high styrene resins can do the same or better without increasing price of stock? Any other comments?

Answered by Mr. Holt: It has been our experience that high styrene resins give higher tensile and modulus in GR-S stocks at about the same hardness and elongation. On a pound-volume basis, the Durez resin is slightly less expensive and so on an efficiency basis I am sure that a high styrene resin will do everything that the other material will. It is difficult to make a blanket statement—each type of material has its own advantages and disadvantages and the choice is usually dictated by the end-use of each particular compound.

Question—What additional power requirements are needed to warm up resin-rubber blends over straight rubber compounds?

Answered by Mr. Holt: With rubber-high styrene resin blends, the difference in peak load for a Shore A 90 to 95 stock might be 20% over the same compound not containing the resin. The non-resin compound would of course not have the same hardness or modulus when cured. In comparing two stocks of equal hardness and stiffness, one reinforced with resin and the other being loaded with fillers, the peak power-demand of both is fairly close. As the resin-reinforced compound warms up, however, the power demand falls off due to the plasticizing effect of the resin. The loaded stock on the other hand shows only a slight drop in power demand.

Question—What are the recommended mixing temperatures for best properties of butadiene-styrene and acrylonitrile-styrene resins in rubbers?

Answered by Mr. Crater: The mixing temperature and method of addition, to achieve the best mechanical characteristics of any thermoplastic or thermosetting material, are very important. If, for example, a blend of butadiene-acrylonitrile and vinyl resins is mixed at too low a temperature, such as 200° F., the vinyl resin does not go in solution and merely acts as a filler. The mixing temperature is predicated on the molecular weight of the individual resin and rubbers used in the blend, and in the foregoing example, temperatures in excess of 300°F. are generally required. Acrylonitrile-styrene resins are generally mixed with nitrile rubbers at temperatures between 330°F. and 370°F.

Question—In a phenolic resin-polymer blend do you have any suggestions for cross-linking the resin and curing the rubber in separate stages or at different temperatures?

Answered by Mr. Bascom: In my opinion, it would be extremely difficult to develop a blend in which the resin was cross-linked or cured at a different time or temperature than the curing of the rubber in the blend. Several factors would influence such an attempt. The major one would be the fact that the "hexa" used in curing the resin acts as an activator for the rubber phase. There is even a possibility that the more desirable properties that are obtained from blends of phenolic resins and rubbers depend on mutual curing ability. Certainly this is true in the use of phenolic resin or phenolic resin-rubber blends as adhesives for nitrile rubbers. If the curing systems of the adhesive and the rubber are not at about the same rate and at about the same temperature, very poor adhesion results.

Question—Why is it that cures are adversely affected when a phenolic resin is added to a rubber compound?

Answered by Mr. Bascom: When phenolic resins are added to nitrile rubber compounds, most of the time the cures are accelerated so that the compounds are quite scorchy. I can only conclude that this question referred to the addition of either phenolic resins which are not compatible to nitrile rubbers or to other rubbers in which there is no compatibility. In this case, the phenolic resin acts as a very coarse and very poor filler for the compound and would contribute nothing to the end results other than a degree of mushiness.

Question—Frequently blends of acrylonitrile polymers and phenolic resins are inclined to be scorchy. Is it possible to improve this characteristic by the use of retarders which are normally effective in rubber stocks, or are there other materials which might be used to improve scorch?

Answered by Mr. Bascom: There is no doubt that blends of nitrile rubbers and phenolic resins are quite scorchy. While I do not know of any retarders that effectively prevent this scorchiness, it is possible to obtain from the resin manufacturers resins which are compatible with nitrile rubbers that contain either no "hexa" or half as much "hexa" as in the normally used phenolic resins. Thus, the resins which have little or no "hexa" in them are considerably less scorchy and make compounds which are considerably less scorchy than the regularly used resin. However, the absence of "hexa" from the compound certainly does not make as good a stock as if the "hexa" were present; therefore, my best solution to this problem is the use of phenolic molding techniques in order to handle such blends rather than rubber processing techniques. That is, I would make a compound, mix it in whatever way one desired, sheet it out as thin as possible and then granulate the compound. This granulated compound can then be molded in the same way that the phenolic molding compounds are molded. This method avoids putting a great deal of heat history into the phenolic and means that the compounds can be handled without any difficulty.

Question—What are the governing factors of compatibility when it is desired to blend phenolic resins with straight PVC resins when: (1) plasticizer content (TCP) is low (ca. 5-10 phr), (2) plasticizer content (TCP) is high (ca. 60-80 phr), (3) plasticizer content is comprised of polymeric and D.O.P. and quantity is average (ca. 20-40 phr)?

Answered by Mr. Bascom: PVC resins and phenolic resins have approximately the same compatibility characteristics as do nitrile rubbers and phenolic resins. This inherent factor of compatibility is not particularly influenced by the plasticizer content although generally a liquid ester type plasticizer is not very good in a phenolic system. Therefore, a polymeric or a rubber type plasticizer would be preferred in such a blend. A very serious limiting factor in the usefulness of PVC-phenolic blends is the fact that phenolic resins normally cure with the evolution of gas both from the decomposition of the "hexa" and from the water formed during the condensation reaction between the formaldehyde and the phenolic. This gas formed during cure means that the blend is very difficult to cure in open air or steam. However, such blends can readily be cured in presses or closed molds.

Question—The companies manufacturing phenolic resins have materials which are claimed to be very compatible with GR-S and natural rubber. Can you give us any information on the compounding and processing problems with these blends and the extent to which they are finding usage in the industry?

Answered by Mr. Bascom: Certain phenolic resins are compatible with GR-S and natural rubber in that they cure together without interfering with the cure of either component. However, when these resins are used in shoe sole compounding they contribute only to the hardness of the compound and have an adverse effect on flex life. Accordingly, it is my impression that these are used in combination with high styrene resins for reinforcement of shoe soles and are rarely used to an extent larger than 50% of the total resin reinforcement. I believe also that such combination resin reinforcement systems are used only in inexpensive or cheap shoe soles.

Question—Does the use of nitrile rubber always reduce the tensile strength of PVC compositions?

Answered by Mr. Smith: We have not found, in any of our work, that the addition of nitrile rubber will result in an increase in tensile strength over what is obtainable by plasticizing the vinyl chloride resin with liquid plasticizers to equivalent flexibility. It is possible, however, to maintain or only slightly reduce tensile strength by making certain the mixture is completely fluxed at a high enough temperature to provide optimum fusion of the vinyl. On this basis, up to 40 parts of nitrile rubber can be added to the vinyl chloride composition, with proper adjustment of liquid plasticizer for final flexibility, without an appreciable effect on the tensile strength of the mixture.

Question—Is it possible to obtain knotty tear with PVC compounds?

Answered by Mr. Smith: If this gentleman means by knotty tear the tendency for a tear to show a character of intermittent resistance and non-resistance, I would say that it is difficult to obtain any other kind of a tear with PVC and nitrile rubber blends. Only the most intimate and most thorough mixing of the vinyl chloride and nitrile rubber will give a smooth tear. Incomplete breakdown of the rubber before being added to the vinyl or addition of the rubber after the vinyl is fluxed will generally result in a marked knotty tear. One way of obtaining a smooth tear is to co-coagulate and co-precipitate the rubber latices. Proper subsequent processing will usually produce a sheet with a smooth tear. A knotty tear can be obtained with a non-rubber PVC film or sheeting by using high filler loadings or by use of moderate to high amounts of solid plasticizers.

Question—How does the cost of nitrile rubber compare with the cost of suitable liquid plasticizers?

Answered by Mr. Smith: Cost is only one of the reasons why nitrile rubbers have not had more widespread application as plasticizers for vinyl chloride resin. The most compatible of the N rubbers, with the higher acrylonitrile contents, are about 58c per lb., while the lower acrylonitrile content rubbers are in the neighborhood of 50c per lb. This compares with DOP currently selling at 35c per lb. However, to achieve the resistance to oils and aliphatic hydrocarbons and the retention of flexibility upon prolonged heat exposure required for some vinyl chloride applications it is necessary to use either polymeric plasticizers or N rubbers. The polymeric plasticizers which are most effective cost from 68 to 85c per lb. and some are only slightly more efficient in producing flexibility than the N rubber. Processing difficulties and light stability rather than cost are the major factors dictating use of liquid polymeric plasticizers in preference to the N rubbers.

Question—What combinations of vinyls and other resins can be used for the manufacture of garden hose?

Answered by Mr. Crater: Combinations of vinyl resins and nitrile rubbers are excellent compounds for subsequent extrusion into garden hose, wire and cable coverings, and for numerous other applications. These combinations can be further plasticized with either monomeric or polymeric type plasticizer. For specific applications, much higher loadings can be used in the vinyl nitrile blends than with compounds based on a mixture of vinyl resin and plasticizer only. Despite the cost of the rubber, low cost stocks are possible.

Question—What heat stabilizers are suggested for blends of nitrile rubber and PVC, both lead type and lead-free type?

Answered by Mr. Smith: Lead stabilizers such as Dyphos and Dythal, lead silicate and lead stearate can be satisfactorily used. Non-lead stabilization which is suitable includes the cadmium-barium mixtures such as Argus Chemical's Mark XI, Ferro 1820 and Harshaw's 2V4 and IV3 coupled with suitable chelating agents such as Argus Chemical's Mark XX,

Ferro 903, Advance Chemical's CH-20 or Harshaw's 7V1. Addition of stabilizing plasticizers like Paraplex G-60 or G-62 also aids heat stability of these blends and is particularly useful with the cadmium-barium combinations. A straight cadmium stabilizer such as Firestone's ST-100 will also do a good job of heat stabilization for such blends. The tin stabilizers which have appeared to be most useful include Metal and Thermit's RS-20 and their Thermolite 99. The rubber should also be stabilized with suitable antioxidants. Deenax, Wingstay S, Ionol, and Agerite Stalite are commonly used.

Question—What light (U.V.) stabilizers are used?

Answered by Mr. Smith: We do not know of any way to achieve light stability, as measured by color fastness, in vinyl chloride-nitrile rubber blends which is equivalent to the light stability of vinyl chloride plasticized with liquid plasticizers such as DOP. Lead stabilizers such as Normasal and Dyphos will aid light stability of the vinyl portion of the mix. Generally, the non-lead heat stabilizers such as the barium-cadmium, straight cadmium, or tin compounds, if used in quantities slightly greater than minimum requirements for heat stabilization, will add to light stability. Some further improvement in light stability can be obtained by use of tin stabilizers, such as dibutyl tin dilaurate, or Vanstay L. Both heat and light aging of the rubber in the mixture are aided by addition of antioxidants such as Agerite Stalite, Deenax, Ionol, and Wingstay S. In general, substituted high boiling phenols are useful in this regard.

Question—How do blends of nitrile rubber and PVC compare in heat stability characteristics as compared to 100% PVC during processing?

Answered by Mr. Smith: In comparing the heat stability characteristics of one vinyl chloride resin composition with another we usually note both the stiffening effect of the heat exposure and the color change. In oven exposures, vinyl chloride-nitrile rubber blends show more color change than vinyl chloride plasticized with straight liquid plasticizers such as DOP but they do not stiffen as much. This color change is accentuated during processing because of the added frictional heat build-up in the nitrile rubber compositions.

Question—What are the economics of using the rigid thermoplastic resin-rubber blends in comparison with other thermoplastics? Can soft vinyl nitrile blends compete with other rubber compounds?

Answered by Mr. Crater: Prior to considering price, the end-use requirements must be considered and the proper material chosen to do the job at the most economical price. In addition to the price of the molding powder, its gravity, and also the possibility of re-engineering the part to possibly use less material, must be considered. The hard thermoplastic butadiene-acrylonitrile and styrene-acrylonitrile blends in molding powder form are sold for approximately 58 to 65 cents per pound—gravity approximately 1.05. For specific applications such as pipe, other materials such as polyethylene and the styrene copolymer molding powders are less expensive in raw material form. In general, the resin-rubber blends have a lower pound volume cost than the cellulosic materials used for this same application. The mechanical advantages of the resin-rubber blends such as higher bursting strength or effective tensile strength often allows the use of thinner wall pipe, thus making it more economical than many materials for specific applications.

In the past two years several rubber parts have been replaced with vinyl or thermoplastic resin-rubber blends. Since the raw material cost of the thermoplastics is generally considerably higher than either virgin or reclaimed rubber stocks, processing, labor involved, and re-engineering of the part is necessary to achieve lower cost. An example of this is an injection molded vinyl arm rest covering used by one of the automotive companies about two years ago. Since the part could be manufactured at higher speeds with less labor and had been engineered to use less material it was more than competitive with its rubber counterpart.

Question—What applications do rubber-resin blends have in tire compounding?

Answered by Dr. Urbanic: They are utilized for obtaining superior adhesion between rubber and either rayon or nylon cord in tire building. The specific materials are a mixture of resorcinol-formaldehyde resin and a vinyl pyridine rubber usually applied to the cord from a latex mixture.

Answered by Mr. Sell: The thermoplastic nature of most of the resins (excluding the phenolics) limits their use in tire compounding. Even in the cured blends, where thermoplasticity is reduced, the poorer resilience of the resin-rubber compound as compared to the rubber-black compound rules out its use.

Question—Please discuss the hysteresis characteristics of rubber-resin blends in comparison to Hevea and GR-S.

Answered by Mr. Holt: It is assumed that blends of a somewhat rubbery or resilient nature are meant. Practically all rubber-resin blends are characterized by high hardness and modulus and any deforming force must be of a fairly high order. Reinforcing resins can be considered more plastic than elastic and when deformed tend to hold to the deformed shape. Consequently, a blend high in resin content when subjected to a large force will take a permanent set. In short, hysteresis is high. In considering high styrene resins, for example against phenolics, the former vulcanize to a thermoelastic condition whereas the thermosetting phenolics are completely rigid at all temperatures. A vulcanized blend of high styrene resin and rubber starts out initially with high hysteresis. As the compound temperature increases, the hardness and modulus decrease and the hysteresis characteristics improve. In other words, the resin phase "unfreezes" and allows the more elastic rubber phase to become more evident. It is extremely rare that a resin-reinforced compound will be considered for a dynamic application.

Question—Are any limitations on usage imposed by the thermoplastic nature of the resins?

Answered by Mr. Sell: Definite limitations on usage of rubber-resin blends are imposed by the thermoplastic nature of the resin. These blends cannot be used at temperatures above the softening point of the blend without serious distortion of the part. This is true regardless of whether the blend is vulcanized or unvulcanized. It should be recognized that while the thermoplasticity is treated as a limitation and disadvantage in the above instance, it is the basis upon which the rapidly growing "post forming" type of operation is built.

Question—What types of mold lubricants are most effective for resin-GR-S blends?

Answered by Mr. Sell: The addition of resin to rubber, particularly in the curing type formulations, aids the release from the mold. If a release agent is required, the silicone types have been found to be very effective giving numerous heats without repeated application. One precaution: use it sparingly in each application.

Question—What lubricants are best for mold release of a nitrile rubber-reclaim-phenolic resin compound loaded with 300 parts of clay when cured to a Shore Type D hardness of 65 to 75 when used on a deep draw product?

Answered by Mr. Bascom: Because nitrile rubber-phenolic resin compounds are inherently good adhesives, it is necessary to add lubricants to the compound in order to prevent adhesion to the mold. Such materials as high stearic acid, high paraffin or lithium stearates or other lithium waxes or combinations of these are very valuable in the compound. Enough should be added so that you get a slight bloom after cure. If additional lubricant is required in order to free the part from the mold, especially on a deep draw product, it might be desirable to use a silicone mold lubricant, many of which are available from many suppliers.

Question—What has been the reaction of any given industry, as for instance the appliance industry, to high impact polystyrenes?

Answered by Dr. Urbanic: Generally speaking, the high impact polystyrenes are satisfactory in the appliance industry, as for instance in making refrigerator parts, except for the following three complaints: (1) There is a certain amount of breakage, especially in transit, and the larger the part the greater the breakage; (2) The heat distortion is too low in the Texas-Arizona areas; heat distortion is 170°F., and (3) Resistance to butter, oils, and insect sprays is poor.

Question—Is there any way to improve the heat stability of nitrile rubber?

Answered by Dr. Urbanic: The stability of nitrile rubber at high temperatures is still poor. Various antioxidants have been proposed and we have tried many but for very severe temperature conditions we have no answers. Materials like NBC prevent a change in physical properties but improve the ultraviolet stability just a little in terms of crazing.

Question—Which of the rubber-resin blends gives the best resistance to 15% nitric acid at 140°F. and at 200°F.?

Answered by Mr. Crater: The butadiene-acrylonitrile styrene blends, or Kralastic, immersed in 25% nitric acid for one week at 74°F. lose approximately 0.5%. Marvinol NR-7045 and unplasticized polyvinyl chloride show no change in weight after 30 days in 25% nitric acid at 74° F., and a slight gain of 0.2% in weight after seven days in 25% nitric acid at 158°F.

Answered by Mr. Bascom: Although PVC nitrile rubbers and phenolic resins are all quite resistant to volume change and degradation in 15% nitric acid at 145°F., any blends of these would be quite serviceable. However, at 200°F. it would probably be desirable to use a thermoset blend; therefore, we would suggest a blend of nitrile rubber and phenolic resin or a blend of nitrile rubber and the styrene-acrylonitrile copolymer. In any case, the blend should probably be thermoset. 200°F., however, is well above the softening point of even rigid PVC compounds, and there is no combination with rubber which we would expect to be suitable at this temperature.

Answered by Mr. Smith: We are not very familiar with exposures of nitrile rubber-vinyl chloride blends to 15% nitric acid. Rigid, unplasticized PVC has excellent resistance to such exposures but nitrile rubber itself is known to have poor resistance to dilute or concentrated nitric acid. I would expect that addition of nitrile rubber to the vinyl chloride would give an unsuitable product except with very low percentages of the rubber. Below 10% it might be all right.

Question—What about patents on these blends? Who has them, are there any restrictions on their use; any precautions which users should take to avoid infringement; is there any litigation going on or pending?

Answered by Dr. Stavely: There is a philosophy on patents that has been expressed in this manner: "Go ahead and do what you want to as it is the lawyer's job to get you out of trouble later."

New Passenger Tire Gauge

A real "consumer" tire gauge, made specially for low pressure tires, has been announced by A. Schrader's Son, Division of Scovill Manufacturing Co., Inc., Brooklyn 38, N. Y. Called the No. 5050-A Gauge, the new unit has a sturdy brass barrel with bright nickel finish. Easy-to-read calibration, from 16 to 36 in one pound units, appear on both sides of the flat scale bar which has a convenient deflector at one end. Although less than four inches long, the unit has the accuracy of larger, heavier gauges. The new gauge is put up in a three-color package containing five gauges. Each gauge is packaged in a separate plastic container which protects it from dust and damage and lends a "quality look" to a quality product.

Some Recent Developments in Vinyl Resin Products

EVERY month witnesses the introduction of several new products based on the vinyl resins. These products range from those of direct consumer interest to specific industrial purposes. Some of the more interesting items which have entered the field, based on information supplied by the Bakelite Company, a Division of Union Carbide and Carbon Corporation, are described in the following paragraphs.

New Spray-On Surgical Bandage

Less than one-tenth the normal time for local treatment of burns and wounds is required with a new liquid surgical dressing based on vinyl resins which is sprayed from an aerosol-type dispenser to form a flexible and transparent film over the injury. Recently made available for professional use only, this radically new surgical dressing has been commercially developed and is being supplied by Aeroplast Corp., Dayton, Ohio. Successful clinical tests of the new treatment on human patients have advanced the original research development made for the U. S. Air Force Aero Medical Laboratory in Dayton, Ohio.

A tough, adhesive, flexible and quick drying film, the new dressing is based on Bakelite vinyl resins which are resistant to water. Operated by pressing the nozzle down with one finger, the aerosol bomb dispenser sprays evenly over the injured area a transparent film that adheres to the skin, seals out contaminants and keeps body fluids in. The flexibility of the new dressing as compared to the awkward bulkiness of a standard ointment-and-gauze bandage, permits early exercise of burned hands, causes less restriction and pressure on sensitive areas, and is more comfortable during hot weather.

Because the film based on Bakelite vinyl resins is sufficiently permeable to water vapor, perspiration does not become trapped under the dressing. For a burn covering 25 per cent of the body area, a doctor and nurse would take more than 30 minutes to apply about 1½ pounds of ointment, 33 square feet of 4 by 4-inch gauze compresses and 60 yards of 3-inch elastic bandage, as compared to the spray from two 6-ounce aerosol bombs which a doctor or nurse can apply in less than three minutes.

This compact, easy-to-apply dressing requires a minimum of storage space and is ideal for emergency treatment by doctors of wounds or burns under adverse conditions. Proper medical treatment with drugs, antibiotics and other systemic therapy should accompany the use of the new spray-on surgical dressing which is essentially a liquid "bandage" for burns and wounds. The solvent used to make this spray is combustible and suitable precautions must be taken in its use.

New Foam Produced Continuously

Soft, flexible foam that breathes can be produced and molded continuously as a cushion backing for textiles and other materials by a new method employing plastisols based on Bakelite vinyl resins. Continuous process equipment and plastisol solution developed by Elastomer Chemical Corp., Newark, N. J., produce a cured foam that is easily fabricated at a price comparable to foam rubber. The foam breathes because the gas mechanically mixed with the plastisol produces interconnecting cells uniformly distributed in molded tubes, blocks or rolls eight inches or more in thickness. Subjected to a gas flame, foam rubber continues to burn furiously after the flame is removed while the foam plastisol based on vinyl resins scorches under the flame but is self extinguishing when the flame is removed.

Continuous foam sheets of almost any thickness and widths up to 60 inches are cured in high-frequency dielectric ovens and molded at the same time directly to natural or synthetic textiles, Krene film and sheeting and similar materials. Easily controlled variation of the plastisol formulation, or the foaming or molding technique, alters tear strength, elongation, chemical resistance and other properties over a range comparable to all but the lightest foam rubber up to the hardest flexible sponge rubber. The long wearing, non-hardening and non-oxidizing qualities of the cured foam are due to the resistance of Bakelite vinyl resins to abrasion, moisture, acids, alkalies and most chemicals.

Depending on the density desired, production rates varying between 150 to 350 pounds per hour are achieved with an average-size foamer. Larger units produce up to 1000 pounds per hour. Increased gas retention which lowers the foam density is obtained by cooling the mixture in the mixing head with ammonia from a compression cooling system. Expanded foam discharges continuously through a hose and nozzle into open or closed molds or directly onto conveyor belts where it can be rapidly cured in sheet form with high-frequency dielectric ovens. A conveyor only 30 feet long, for example, uses a five kilowatt dielectric oven to cure continuous sheeting ¼-inch thick and 14 inches wide at a rate of 3 feet per minute.

Equipment can be made to cure the foam continuously or in stationary molds at almost any desired rate or thickness in widths up to 60 inches. This foamed plastisol cures at about 250° F. without shrinkage in the mold and needs no mold release agents.

Cold-Weather Raincoat for Men

A new, year-round raincoat for men is made of Krene film specially compounded to stay flexible at freezing temperatures. The raincoat provides maximum weather protection because Krene resists water and all seams are electronically welded. Weighing 20 ounces, it folds into a compact, light package. At 32° F. in a refrigerator the new raincoat remains pliable and easy to unfold. Raglan sleeves and full-flared design permit freedom of action even when worn over heavy clothing. A triple layer of Krene around the snap fastener openings gives added strength at those points. A wide collar protects the neck from driving rain or sleet and deep, outside pockets are reinforced at their openings. Available in small,medium, large, and extra-large sizes, each with a pouch for convenient carrying or storage. The new raincoat is light tan in color and embossed to feel like fabric and to provide a surface that will not reflect glare or highlites. The new raincoat is made by the Hodgman Rubber Co. of Framingham, Mass.

No prior bandsawing or preliminary cutting is needed for most plastic parts to be granulated by the new **Model 20 Granulator** introduced by the Cumberland Engineering Co., Providence, R. I. The heavy-duty, all-steel unit, with 7 x 20-inch throat opening, is built to reduce parts that are too heavy in cross section and hence too difficult for conventional granulating machines to handle.

The Reinforcement of Butyl with Carbon Black

Part IV—Effect of Polymer Composition and Molecular Weight on Efficiency of Heat Treatment

By JOHN REHNER, Jr., and A. M. GESSLER

Esso Laboratories, Chemical Division, Standard Oil Development Co., Elizabeth, N. J.

THE preceding papers in this series *(1, 2, 3)* have presented evidence showing that the stress-strain, damping, and abrasion properties of Butyl vulcanizates, and also their resistance to chemical attack, are markedly improved through heat treatment of the Butyl-carbon black masterbatches. Practically all of the earlier work was carried out with a single commercial grade of Butyl (GR-I-17). Since the chemical unsaturation (isoprene group content) and the molecular weight of Butyl polymers can be varied considerably by modifying the conditions of synthesis, the present investigation was undertaken to determine how changes in these polymer properties influence the efficiency of heat treatment.

Polymers Employed

Table I lists the Butyl polymers employed in this study, together with their unsaturation and molecular weight values. In addition to the various commercial grades of GR-I shown, some experimental samples which were specially synthesized were included for the purpose of obtaining a broader range in the polymer variables. Polymer unsaturation was determined by the drastic iodine-mercuric acetate procedure *(4)*, and molecular weight was obtained from the intrinsic viscosity of polymer dissolved in diisobutylene *(5)*. From Table I it was then possible to select sets of polymers characterized by (a) variable unsaturation and practically constant molecular weight, and (b) variable molecular weight and practically constant unsaturation.

Compounding and Heat Treating

Channel black masterbatches were mill-mixed under standard conditions *(1)* according to the following recipe: Polymer 100, MPC black 50, and stearic acid 0.5. One half of each masterbatch was retained as a control, and the other half was heat treated under static conditions (4 hours at 320°F. in open steam). Compounding of the untreated and the heat-treated masterbatches was then completed by adding: Zinc oxide 5, sulfur 2, tetramethylthiuram disulfide 1, and benzothiazyl disulfide 1. The stocks were cured at 307°F. Inspection of the tensile data showed that vulcanizates cured for 45 minutes were sufficiently close to optimum in all cases to permit comparisons of their properties at this common time of cure. Table II shows the effect of heat treatment on the processing and vulcanizate properties of the various polymer systems. The figures which follow were constructed with the data of Tables I and II.

Effect of Polymer Unsaturation

The effect of polymer unsaturation on the efficiency of heat treatment is shown in Figure 1. Here, the 300 per cent moduli of the untreated and the heat-treated vulcanizates are plotted against polymer unsaturation. Two sets of polymers are represented in this plot; one set (Nos. 1, 3, 5, and 10 in Table I) had molecular weights of 310,000 to 325,000, and the other set (Nos. 4, 7, 8, 15, and 16) had molecular weights of 400,000 to 450,000. The points conform rather satisfactorily to straight lines which can be extrapolated to the origin.

The efficiency of heat treatment is proportional to the change in modulus, that is, to the vertical distance between the curves for the untreated and the heat-treated vulcanizates. This enhancement in modulus is seen to be directly proportional to polymer unsaturation. Although the two sets of points in Figure 1 appear to fit single curves fairly well, it will be shown below that the efficiency of heat treatment is not independent of molecular weight. The data in Figure 1 represent only two molecular weight ranges, and these do not differ greatly in their values.

It was shown in Part I *(1)* that the effect of heat treatment is not due to a change in state of cure. Since the elastic modulus of a carbon black vulcanizate is largely

TABLE I — DESCRIPTION AND PROPERTIES OF BUTYL POLYMERS USED IN PRESENT STUDY

Polymer Number	Description	Mooney Value of Raw Polymer (8 Min. at 212°F.)	Unsaturation (Mole %)	Molecular Weight (Viscosity-Average)
1	R-2	39	0.89	325,000
2	GR-I-40	40	1.20	278,000
3	GR-I	45	1.28	310,000
4	GR-I-70	63	1.32	445,000
5	GR-I-14	41	1.80	315,000
6	GR-I-15	48	1.68	370,000
7	GR-I-16	57	1.59	445,000
8	GR-I-17	59	1.48	445,000
9	GR-I-18	75	1.38	505,000
10	GR-I-25	45	1.88	325,000
11	Special	87	1.25	685,000
12	Special	86	1.67	920,000
13	Special	88	1.73	730,000
14	Special	77	1.68	555,000
15	Special	59	1.91	450,000
16	Special	56	2.03	400,000

TABLE II—EFFECT OF HEAT TREATMENT ON PROCESSING AND VULCANIZATE PROPERTIES (A = Conventional Mixing; B = Heat Treated)

Polymer No.*	1 A	1 B	2 A	2 B	3 A	3 B	4 A	4 B	5 A	5 B	6 A	6 B	7 A	7 B	8 A	8 B
Masterbatch Properties																
Mooney (8'/212° F.)	32	65	68	72	65	83	102	110	72	73	77	77	92	100	99	108
Extrusion rate (in./min.)	104	103	118	115	117	115	86	74	103	103	102	105	98	98	89	94
Extrusion rate (g./min.)	133	127	139	125	139	120	100	70	125	119	125	118	116	96	100	88
Vulcanizate Properties (45'/307° F.)																
Modulus at 300% lb./in.²	660	900	915	1550	910	1645	900	1550	1060	1750	1150	1835	1175	1780	1040	1890
Tensile Strength, lb./in.²	3010	3250	3060	3350	3200	3410	3250	3600	2950	3150	3100	3150	3240	3430	3250	3175
Elongation, %	750	690	640	540	670	510	675	550	590	455	590	450	540	340	485	440
Tear Strength, lb./in.	500	455	420	300	395	330	370	270	315	235	365	240	370	235	615	250
Electrical Resistivity, ohm-cm.	3.81×10^{7}	4.79×10^{7}	4.05×10^{7}	7.64×10^{7}	3.89×10^{7}	6.18×10^{7}	3.94×10^{7}	7.69×10^{7}	4.11×10^{7}	5.46×10^{7}	3.91×10^{7}	1.51×10^{8}	3.88×10^{7}	2.21×10^{8}	3.91×10^{7}	1.21×10^{8}
Internal Viscosity, poises × 10^{-6}	15.2	8.79	9.26	5.61	11.0	6.80	8.99	5.18	9.40	5.56	9.05	4.96	9.07	5.22	8.91	5.78
Frequency, cycles/sec.	5.35	5.04	4.90	4.72	5.07	4.70	4.97	4.53	5.16	4.79	5.14	4.59	5.22	4.62	5.10	4.71
Dynamic Modulus, dynes/cm² × 10^{-7}	11.6	9.59	8.59	7.44	9.76	7.86	9.35	7.26	10.10	8.08	10.10	7.50	10.30	7.57	9.85	8.35
Relative Damping, %	44.0	31.30	34.90	24.90	37.30	28.00	32.10	22.90	32.20	23.30	31.20	21.70	31.00	22.60	31.10	23.10

Polymer No.*	9 A	9 B	10 A	10 B	11 A	11 B	12 A	12 B	13 A	13 B	14 A	14 B	15 A	15 B	16 A	16 B
Masterbatch Properties																
Mooney (8'/212° F.)	109	115	75	76	107	107	104	100	130	127	112	110	95	98	90	90
Extrusion rate (in./min.)	75	68	104	110	50	43	39	46	100	109	79	85	100	98	101	106
Extrusion rate (g./min.)	84	62	126	125	49	36	35	39	79	87	85	85	114	100	119	111
Vulcanizate Properties (45'/307° F.)																
Modulus at 300%	1080	1610	1340	2100	965	1560	1470	2000	——	——	1270	1880	1275	2000	1400	2125
Tensile Strength, lb./in.²	3165	3355	2975	2955	3390	3480	3040	3145	2250	1825	3305	3285	2990	3000	2935	2985
Elongation, %	605	495	540	405	650	515	490	410	270	240	580	455	535	400	510	395
Tear Strength, lb./in.	405	255	340	185	340	250	300	190	205	135	335	205	315	215	315	190
Electrical Resistivity, ohm-cm.	3.80×10^{7}	1.29×10^{8}	3.84×10^{7}	2.81×10^{8}	3.75×10^{7}	5.88×10^{8}	4.06×10^{7}	2.96×10^{8}	1.05×10^{8}	1.37×10^{8}	4.02×10^{7}	2.31×10^{8}	3.83×10^{7}	8.84×10^{8}	3.89×10^{7}	2.80×10^{8}
Internal Viscosity, poises × 10^{-6}	9.90	6.63	8.40	5.17	8.97	5.71	8.27	5.77	7.70	6.42	8.35	4.82	8.84	5.01	9.04	5.01
Frequency, cycles/sec.	5.11	4.72	5.04	4.59	4.97	4.81	4.81	4.85	5.20	5.05	5.04	4.63	5.04	4.65	5.17	4.69
Dynamic Modulus, dynes/cm² × 10^{-7}	9.88	8.44	9.57	7.89	9.39	8.17	9.30	8.92	10.80	10.80	9.60	7.63	9.59	8.12	10.80	8.24
Relative Damping, %	34.00	25.90	30.00	21.50	31.90	23.70	29.20	22.30	25.80	21.50	29.80	21.00	31.30	20.60	29.60	20.50

* See Table I for descriptions and properties of the polymers.

a function of the number of polymer-polymer and carbon black-polymer links, Figure 1 indicates that heat treatment increases the number of carbon black-polymer bonds through some mechanism involving the isoprene units in the polymer chains, rather than through the enhancement of van der Waals bonds from the isobutylene units.

In contrast to elastic modulus, properties such as dynamic modulus or relative damping depend in a large measure on the cooperative motion of all of the molecular units in the polymer chain. The improvement of such properties by heat treatment would therefore be expected to show less dependence on chemical unsaturation. This is confirmed by Figure 2. Here, the polymers of 310,000 to 325,000 molecular weight give vulcanizates whose internal viscosities decrease with increasing unsaturation. However, the reduction in internal viscosity through heat treatment, represented by the vertical distance between corresponding upper and lower curves, is practically independent of polymer unsaturation.

The curves corresponding to 400,000 to 450,000 molecular weight differ from the others in being independent of polymer unsaturation, at least over the range examined. This suggests that, beyond some limiting value of molecular weight, the vulcanizate may lose cognizance of differences in the concentration of polymer-polymer cross-links resulting from differences in polymer unsaturation, insofar as internal viscosity is concerned. The latter property, therefore, will be determined largely by polymer molecular weight, as will be shown below.

Figure 2 shows that, for the higher molecular weights also, the decrease in internal viscosity caused by heat treatment is independent of polymer unsaturation and is practically equal to that observed for the vulcanizates made with the lower molecular weight polymers. Plots

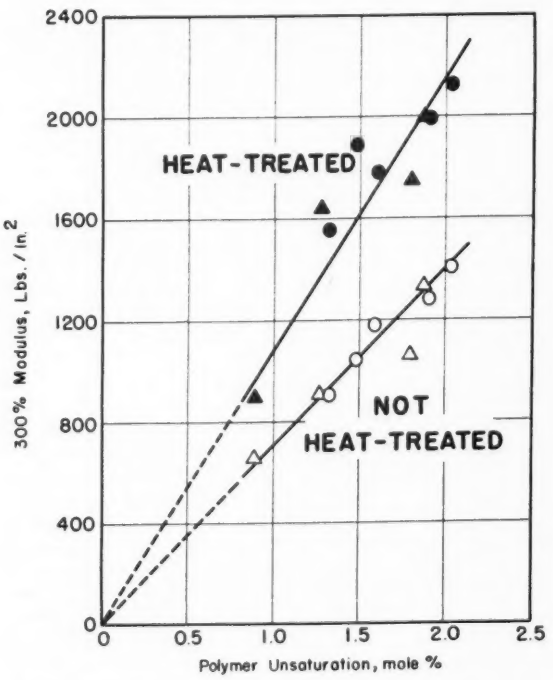

FIG. 1—Effect of heat treatment on variation of vulcanizate modulus with polymer unsaturation. (Triangles denote 310,000 to 325,000 molecular weight; circles denote 400,000 to 450,000 molecular weight).

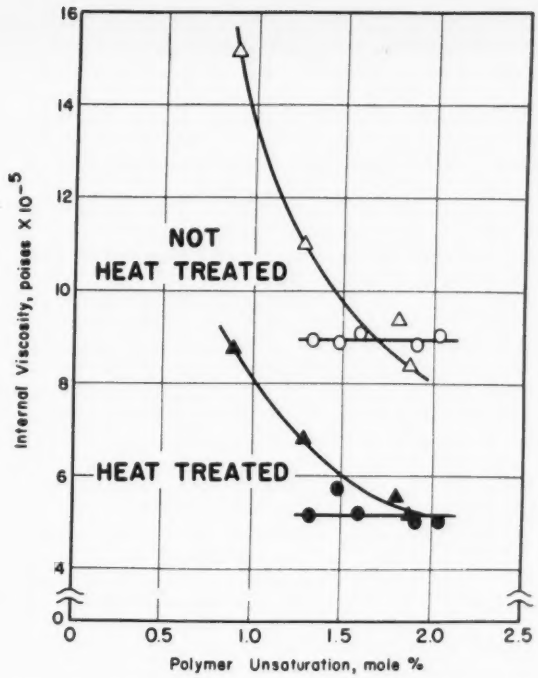

FIG. 2—Effect of heat treatment on variation of internal viscosity of vulcanizate with polymer unsaturation. (Triangles denote 310,000 to 325,000 molecular weight; circles denote 400,000 to 450,000 molecular weight).

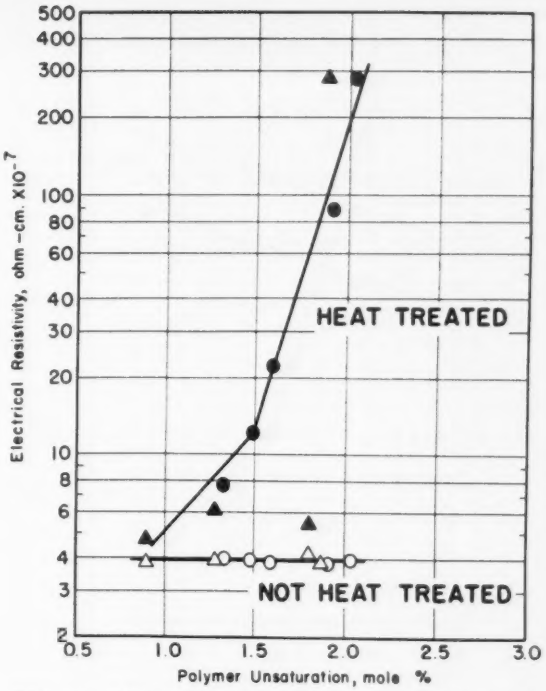

FIG. 3—Effect of heat treatment on variation of electrical resistivity of vulcanizate with polymer unsaturation. (Triangles denote 310,000 to 325,000 molecular weight; circles denote 400,000 to 450,000 molecular weight).

of relative damping against polymer unsaturation give curves very similar to those shown in Figure 2 and can be interpreted in the same manner.

The previous papers in this series *(1, 2, 3)* have explained heat treatment effects in terms of a dual mechanism involving (a) a modification in the carbon-polymer bonds or an increase in their number and (b) a concurrent increase in filler dispersion brought about by virtue of these additional "anchors." Though the dispersion effect, as measured by the electrical resistivity of the vulcanizate, is greatest under conditions of cyclic heat treatment (the alternate heating and milling process described in Part I *(1)*), some changes also occur under static heat treatment, which involves only a single milling step after heat treatment.

If the number of carbon black-polymer bonds resulting from heat treatment is proportional to polymer unsaturation, as has been postulated in the discussion of Figure 1, one should find that the increase in electrical resistivity brought about by heat treatment is greater, the greater the polymer unsaturation. Figure 3 shows this to be the case. Without heat treatment, the inherent degree of carbon black-polymer bonding characteristic of the system is at a relatively low level which is independent of polymer unsaturation. With heat treatment, additional bonds are created in proportion to polymer unsaturation, and there is corresponding increase in dispersion or electrical resistivity.

Effect of Polymer Molecular Weight

Two sets of polymers were selected for this examination; one of these (Nos. 3, 4, 9, and 11) had unsaturation values of 1.25 to 1.38, and the other set (Nos. 5, 6, 12, and 14) had unsaturation values of 1.67 to 1.80. The

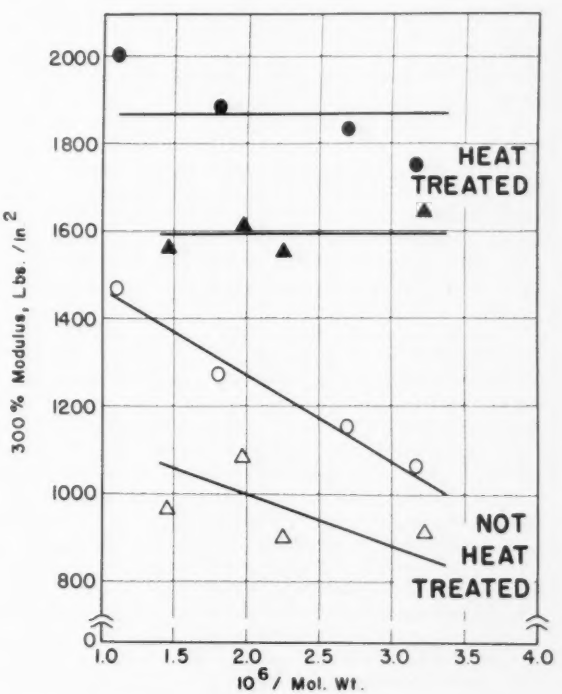

FIG. 4—Effect of heat treatment on variation of vulcanizate modulus with polymer molecular weight. (Triangles denote 1.25 to 1.38 unsaturation; circles denote 1.67 to 1.80 unsaturation).

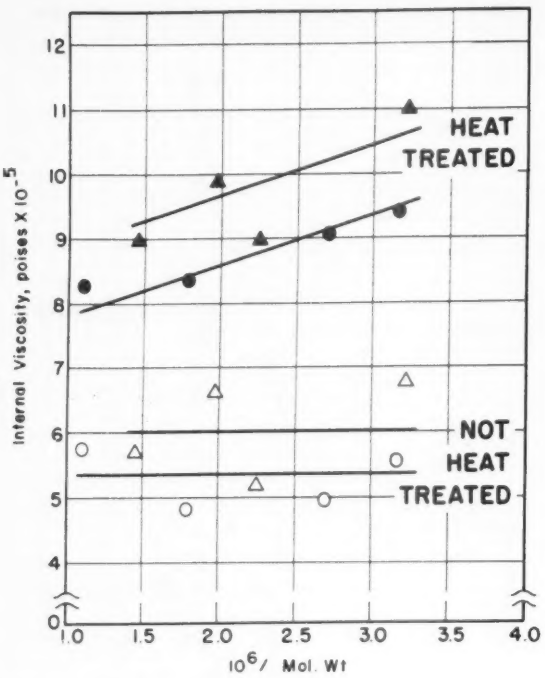

FIG. 5—Effect of heat treatment on variation of internal viscosity of vulcanizate with polymer molecular weight. (Triangles denote 1.25 to 1.38 unsaturation; circles denote 1.67 to 1.80 unsaturation).

300 per cent moduli of the untreated and the heat-treated vulcanizates are plotted against the reciprocal molecular weight of the polymer in Figure 4. Without heat treatment, the vulcanizate modulus decreases linearly with increasing reciprocal molecular weight. With heat treatment, the modulus is independent of molecular weight. The efficiency of heat treatment, given here by the vertical distance between corresponding curves, therefore falls off linearly with increasing reciprocal molecular weight. In other words, heat treatment becomes somewhat less efficient with increasing polymer molecular weight, even though the initial moduli which the higher molecular weight vulcanizates enjoy are such that the final moduli resulting from heat treatment are all practically equal.

Although Figure 4 indicates that, for a given molecular weight, both sets of polymers lead to about the same gain in modulus on heat treating, Figure 1 has shown that this is not quantitatively true. That is, the gain should be somewhat greater for the set having the higher unsaturation, although the experimental error in Figure 4 obscures the small difference that would be expected.

The molecular weight effect can be explained on the assumption that the rate of formation of bonds between the carbon black surface and sites of unsaturation in a polymer chain is inversely proportional to the chain length. That is, under given conditions of heat treatment, longer chains are subject to a greater amount of entanglement or other restraints, and this decreases the frequency with which the reactive sites on the chain can collide with the carbon black surface. Other methods of reducing this collision frequency, for example by adding a diluent or plasticizer to the system before heat treatment or by reducing the temperature of heat treatment, likewise reduce the magnitude of the heat treatment effect *(1)*.

Since the 300 per cent modulus of a Butyl vulcanizate decreases linearly with increasing reciprocal molecular weight of the polymer *(6)*, and the rate of bond formation, according to the above view, is proportional to reciprocal molecular weight, the net effect is to produce in the heat-treated vulcanizate a compensated modulus which is independent of polymer molecular weight, as shown in Figure 4.

Curves similar to those in Figure 4 are obtained when the internal viscosities of the vulcanizates are plotted against reciprocal molecular weight. Figure 5 shows that, without heat treatment, the internal viscosity increases linearly with increasing values of reciprocal molecular weight. With heat treatment, the internal viscosity is reduced and is independent of molecular weight. The efficiency of heat treatment, in this case the reduction in internal viscosity, is somewhat greater the smaller the molecular weight, and shows little or no dependence on polymer unsaturation. Here again, the internal viscosity change appears to be dominated largely by polymer molecular weight rather than by polymer unsaturation, as was the case in Figure 2.

The corresponding curves for the dependence of dispersion or electrical resistivity on molecular weight are shown in Figure 6. Without heat treatment, electrical resistivity is independent of molecular weight. With heat treatment, electrical resistivity increases and the magnitude of the change is greater, the higher the molecular weight. Also, the change is larger for the polymers of higher unsaturation, in agreement with Figure 3. It was previously argued that increased chain length, at constant unsaturation, decreases the rate of formation of carbon black-polymer bonds on heat treat-

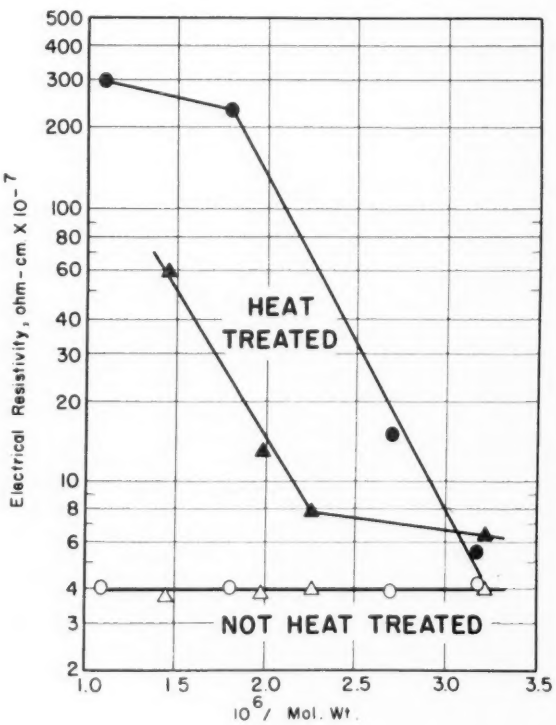

FIG. 6—Effect of heat treatment on variation of electrical resistivity of vulcanizate with polymer molecular weight. (Triangles denote 1.25 to 1.38 unsaturation; circles denote 1.67 to 1.80 unsaturation).

ment. Therefore, the course of the increases in electrical resistivity shown in Figure 6 must be explained on the grounds that the rate of bond formation, which suffers with increased chain length, is more than compensated by the rate of filler dispersion, which should benefit from increased chain length or increased viscosity of the uncured matrix. Some quantitative aspects of this point are given below.

A Theory of Heat Treatment

The factors proposed in explanation of the experimental results presented in this and the preceding papers of this series can be expressed quantitatively as follows. Let n denote the number of carbon black-polymer bonds formed by heat treatment. The rate of formation of these bonds, at a time t of heat treatment, can be written:

$$dn/dt = k_L Au/M \qquad (1)$$

where k_L is the rate constant for bond formation at a given temperature, A is the surface area of carbon black accessible to polymer at time t, u is the number of isoprene units in the system (which will be proportional to the chemical unsaturation of the polymer), and M is the average molecular weight of the polymer. We assume for simplicity that all of the polymer molecules have the same molecular weight. We also assume for the moment that u is independent of the time. (This assumption will not be strictly true if, as has been argued, polymeric unsaturation sites are consumed in forming the bonds. A more accurate treatment will be given later). Let p denote the number of ultimate particles of filler present at time t. The rate of dispersion of aggregates into ultimate particles should be given by:

$$dp/dt = k_D Pn \qquad (2)$$

where k_D is the rate constant for dispersion at a given temperature and for a given set of milling conditions, and P is the number of aggregates present at time t. We assume for simplicity that the ultimate particles and the aggregates are spherical and that the latter are of a size such that each contains n ultimate particles. A word of explanation is needed to define the time scale. In a cyclic heat treatment, the time scales will differ for equations (1) and (2) because, in the former, t will be the time of heat treatment while in the latter, it will be the time of milling. If, as will be assumed below, heat treatment is carried out on a mill or in a Banbury mixer, that is, if bond formation and aggregate dispersion occur concurrently, a single time scale will apply to both equations. The total number, N, of ultimate particles present at a given time will be the sum of those already existing as free particles and those contained in the aggregates, that is:

$$N = p + nP = 6m/\pi\rho\, d^3$$

or

$$P = (N - p)/\bar{n} \qquad (3)$$

Here, m is the mass of carbon black present, and ρ and d are, respectively, the density and the diameter of an ultimate particle. For a given loading N and m are constant. The total surface area of carbon black accessible to polymer at a given time is:

$$A = \pi d^2 p + \pi n^{2/3} d^2 P \qquad (4)$$

$$= \pi d^2 [(2n^{1/3} - 1)p]/n^{1/3} \qquad (5)$$

We are interested in the efficiency with which the bonds produced by heat treatment can yield discrete particles, or in dp/dn. On dividing equation (2) by equation (1), substituting equations (4) and (5) into the result, and integrating under the condition that p=0 when n=0, we obtain:

$$N \ln[N/(N-p)] - p = [k_D M/2k_L u\pi d^2 \bar{n}^{2/3} (2\bar{n}^{1/3}-1)]n^2 \qquad (6)$$

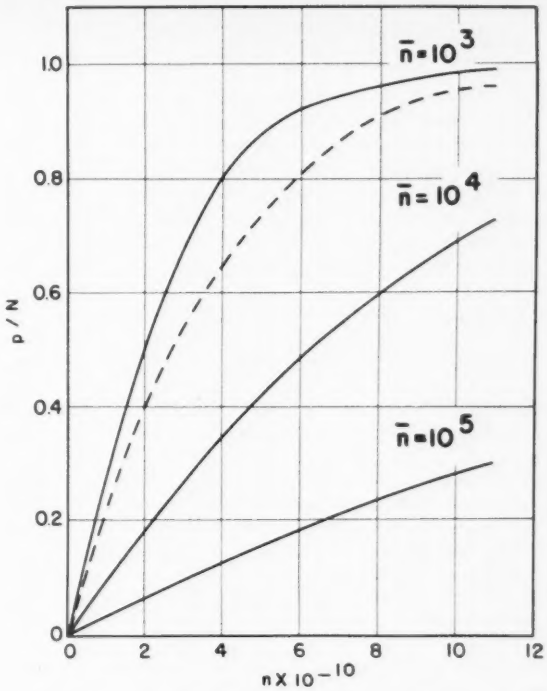

FIG. 7—Theoretical dependence of dispersion on a number of carbon black-polymer bonds for aggregates of various sizes.

Unless the aggregates are very small, say $\bar{n} \ll 1000$, equation (6) can be written in the approximate form:

$$N \ln[N/(N-p)] - p \cong [k_D M/4k_L u\pi d^2]n^2/n \qquad (7)$$

Equations (6) or (7) relate the extent of dispersion p to the number n of carbon black-polymer bonds formed by heat treatment, and to the indicated parameters and rate constants.

For a given system of carbon black and polymer and given conditions of heat treatment, the bracketed coefficient in the right number of equation (7) will be constant. In order to illustrate how dispersion varies with the number of bonds, we can arbitrarily set this coefficient equal to unity. Corresponding values of p/N and n can then be computed from equation (7) for various assumed aggregate sizes, n. Here, the ratio p/N is the fractional degree of dispersion; that is, p/N is the fraction of the carbon black that has been dispersed into discrete particles by virtue of n carbon black-polymer bonds formed in heat treatment. Figure 7 shows dispersion curves that were computed in this manner. (Since the bracketed coefficient in equation (7) was arbitrarily equated to unity, the abscissal values in Figure 7 are only proportional to the number of bonds formed).

It is seen that, for a given size of aggregates, the degree of dispersion increases most rapidly in the earliest stages of bond formation and approaches the limiting value of unity asymptotically. This means that, in practice, it would not be possible to produce complete dispersion with the necessarily finite number of bonds resulting from heat treatment, even though complete dispersion might be approached rather closely. The curves also show that the rate of approach to complete dispersion is smaller, the larger the aggregate size. In other words, a given number of bonds will produce a smaller degree of dispersion if the aggregate size is increased, as would be expected.

It was assumed in the derivation of equations (6) or (7) that the unsaturation of polymer remained constant. However, if the formation of a carbon black-polymer bond results in the consumption of a double bond in the polymer chain, the chemical unsaturation remaining after a time t of heat treatment will be $u = u_o - n$, where u_o is the original number of double bonds in the system. On substituting this expression into equation (1) and carrying out a parallel derivation, it is found that the relation between p and n is now given by:

$$N \ln[N/(N-p)] - p = [k_D M/2k_L \pi d^2] [u_o \ln\{u_o/(u_o-n)\} - n]/\bar{n} \quad (8)$$

On introducing appropriate numerical values of the parameters into this expression and carrying out the computation for n = 1000, one obtains the dispersion curve shown in Figure 7 as a dotted line. This is to be compared with the uppermost solid curve in the figure. The two curves are of the same general nature, the only difference being that the gradual loss of polymer unsaturation through bond formation results in a somewhat reduced efficiency of dispersion.

A rather obvious attempt was made to test the validity of the assumptions on which the dispersion equation is based by an independent method. The ratio of the rate constants, k_D/k_L, and the corresponding difference in the activation energies, were computed as shown below, and the results were compared with the experimentally determined effect of temperature on the rate of heat treatment. The computed results can be used to estimate the order of magnitude of the bracketed coefficient in the right number of equations (6) or (7). At the same time, they serve to illustrate a common pitfall in kinetic treatments. The differential form of equation (7) is given by:

$$dp/dn = [k_D M/2\, k_L\, u\pi d^2 \bar{n}]\, n(N-p)/p \quad (9)$$

Consider a system containing 50 grams of carbon black in 100 grams of polymer. If the carbon black has a density of 1.8 and its ultimate particle diameter is 3×10^{-6} cm., then $N=2.0\times10^{18}$. Let the aggregate size n equal 10^3, and let the polymer molecular weight equal 2×10^5. If the polymer contains 2 per cent by weight of isoprene units, the number of double bonds in the system is $u=1.8\times10^{22}$. At the beginning of the heat treatment process, dispersion efficiency will be greatest (as is shown by the initial slopes of the dispersion curves in Figure 7). If at this stage of the process, each carbon black-polymer bond leads to the formation of one ultimate particle, p=n and dp/dn=1 as n approaches zero.

When the above values are substituted into equation (9) under these conditions it is found that $k_D/k_L = 25.5\times10^{-10}$. The corresponding difference in activation energies is E_D-E_L = 17 kcal. This is in surprisingly good agreement with the value of 16 kcal. which was found (1) from the temperature dependence of the time required for heat treatment to produce a given 300 per cent modulus value in the vulcanizate. Unfortunately, this agreement is a pure coincidence, because the dimensions of the two rate constants differ; the numerical value of their ratio depends on the units employed in expressing the molecular weight and the particle diameter, as can be seen from the bracketed expression in equation (9). The agreement therefore cannot be offered as an independent argument for the proposed mechanism, even though the results of the computation are useful in giving numerical definition to the dispersion equation.

Summary

A systematic study has been made of the effects of polymer unsaturation and molecular weight on the efficiency of heat treatment of carbon black-Butyl masterbatches. The results can be explained by the qualitative mechanism which was proposed in the previous papers of this series, and which is based on concurrent processes of bond formation and aggregate dispersion. A quantitative theory of heat treatment has been developed which expresses the efficiency of heat treatment (expressed in terms of the number of ultimate particles resulting from the formation of carbon black-polymer bonds) as a function of bond concentration, carbon black aggregate size, and certain parameters related to the properties of the carbon black and the polymer present in the mixture.

ACKNOWLEDGEMENT

The authors are pleased to acknowledge the benefit of several valuable discussions of the subject matter with Professor Eugene Guth. Thanks are also due to Mr. J. C. Scarpa and Mr. M. F. Stiles for carrying out part of the experimental work.

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Synopsis for the Series of Articles on "The Reinforcement of Butyl with Carbon Black"

THIS series of papers has described beneficial effects obtained by heat treating Butyl rubber-carbon black mixtures prior to vulcanization. These benefits include lower hysteresis and higher modulus, increased electrical resistivity, greater acid resistance and improved processing properties. It has been suggested that these improvements are attributable to an interaction between polymer molecules and carbon pigment particles. The presence of oxygenated surfaces has been shown to be an important factor in such thermal interaction phenomena.

The beneficial effect of promoting agents in heat treating reactions has also been described. Oxy-blacks will undergo thermal interaction without the use of such an agent. However, the presence of a promoter does increase the rate of reaction markedly. Furnace black and other non-oxy blacks undergo no such reaction without the aid of a promoter. Both inorganic and organic agents have been used to promote thermal interaction in non-oxy black systems. Sulfur is an example of an inorganic agent used for this purpose. Organic com-

pounds such as p-dinitroso benzene (Polyac) and other polynitroso compounds have strong accelerating effects on the heat treatment of Butyl-carbon black mixtures. They have been used extensively in commercial scale operations, with channel black as well as with non-oxy black compositions.

In actual practice, carbon black and promoting agent should be well dispersed in the Butyl rubber at a low temperature. It is preferable to do this, if possible, below the reaction temperature of the promoter—less than 300°F. in the case of Polyac. After a good dispersion is obtained, heat must be applied to the batch. Heat treatment consumes the promoter as polymer-pigment interaction proceeds. Banbury mixing schedules of from 10 to 30 minutes at 300°F. to 400°F. have given satisfactory results. This processing may be carried out in one or several stages, depending upon plant equipment and operating conditions. Continued heating after discharge from the Banbury is beneficial. The capacity of Polyac and similar agents to accelerate vulcanization is destroyed by such procedures, while pigment reinforcement of the polymer is enhanced. Such compositions are therefore not scorchy. Black and shiny in appearance, they have excellent handling and building characteristics. Their vulcanizates possess valuable properties not otherwise available in Butyl rubber.

F. P. Ford

New Spray Process for Coloring Rubber Matting and Treads

MANAGEMENT is discovering that striking and dramatic effects in business decor can be achieved at comparatively low cost through the more extensive use of colored rubber floor matting and stair treads. Rubber floor matting and stair treads are gaining recognition as multi-purpose floor coverings: they protect more expensive floor coverings, deaden sound, reduce the risk of falls, and can contribute in no small way to the over-all decor of an office or building.

Types of Matting on Market

At the present time, there are two types of colored rubber floor matting and stair treads on the market. In solid color matting and stair treads, the color has been intimately mixed throughout the rubber batch and remains unchanged as the rubber wears away. In the other and more decorative colored matting and treads, the color is sprayed on the rubber strips by a gun just before vulcanization. The color is long-lasting but is subject to wear if improperly applied.

This latter type of colored matting and treads has had its life extended by a new spray process developed by the Boston Woven Hose and Rubber Company of Cambridge, Mass. Previously, users complained of uneven wear. Some areas in a strip would wear out sooner than others and replacement was necessary even though the major part of the surface might still be in excellent condition and good for several more years. This was due to the uneven density of the spray.

As any home handyman knows, the paint spray from a gun is conical in shape, the center of the cone is dense and becomes progressively lighter toward the edges. The new Boston spray process remedies this and insures a uniform density over the entire surface of the rubber strip.

The spray gun hangs from a carriage mounted on a rail which traverses overhead the width of the strip moving below. On the first line of travel, the customary spray pattern is made—a dense central area across the entire width and two less dense areas, one on each side of the dense portion. However, the pattern of the second line of travel overlaps that of the first. The adjacent lightly sprayed area of the first pattern becomes the outer area of the second pattern, receiving a double spraying which raises it to equal density with the center of the cone.

This patented Boston feature will give users of colored rubber floor matting and stair treads more uniform wear-resistance and longer-lasting service than ever before. It's an example of how constant improvement in the manufacture of rubber floor matting and hose is giving the user more for his money. New designs, new colors and improved production methods combine to give the user much more value for his dollar in attractiveness and wear than was thought possible only a few years back.

To take full advantage of these advances, of course, requires consideration of many factors, such as the impression one is trying to create, the limits on how much can be spent, the size of the area, and the over-all color design. A good rule of thumb suggested by Boston is this: A colored floor matting and/or stair tread which enhances the decor is economical, and one which detracts is extravagant. The same rule can be applied to this question: How much rubber floor matting should be used? It applies with one additional consideration, namely, rubber floor matting and stair treads are the most economical floor coverings for business and industrial use, according to Boston.

New Economies Now Possible

With uniform wear-resistance now made possible by Boston, plus improved designs and new colors, rubber floor matting and stair treads can assume a new importance in business design. Economical, durable and attractive, rubber floor matting can be used to cover entire surfaces of offices, showrooms, lobbies and corridors. A smart, attractive appearance can be achieved at a new low cost.

This economy will also make it possible to cover areas which formerly would have remained uncovered because of prohibitive cost, including such areas as large general offices or lobbies. The cost of good-looking rugs and carpets would make such a project wasteful. Now, with low-cost, long-wearing, smart-looking colored rubber floor matting, it is well within the budget of even smaller-sized firms.

This, in turn, will give designers much more freedom, enabling them to give more scope to their ideas and imagination without being so tightly strait-jacketed by cost.

Engineering Developments of Rubber: July, 1952-June, 1953

By BETTY JO CLINEBELL

Librarian, Rubber Division Library, University of Akron, Akron, Ohio

THE most important news during the past year in the rubber industry has been the development of a proper plan to dispose of government-owned synthetic rubber plants to private industry. Legislative action has been taken on this matter. The report of the Reconstruction Finance Corporation to the President and Congress on synthetic rubber plant disposal was made public March 2, 1953, and was generally received with approval by the Congress and the industry *(1)*. In May, Representative Paul W. Shafer introduced a plan for selling the $500,000,000 government-owned plants to private industry *(2)*. By August 7, the synthetic plant sales bill had been approved by Congress and the President, after much debate and some changes in the bill. The compromise bill calls for the sale of the plants by January 31, 1955, subject then to 60-day review by Congress *(3, 4, 5, 6)*. A three-man Synthetic Rubber Facilities Disposal Commission was expected to be appointed by the President in September, 1953 *(7)*. In May, 1953, after 12 years of continuous government controls over the consumption of rubber, the National Production Authority removed all controls by revoking NPA Order M-2 *(8, 9)*.

The outlook for the rubber industry is bright, as new records of production and consumption are being made. The use of rubber in the United States in 1952 came within 221 tons of equaling the all-time record set in 1950. Synthetic rubber accounted for 65% of the total rubber consumed. Consumption for 1953 was expected to hit a new high *(10)*. Bearing out this forecast, consumption of rubber for the first three months of 1953 set an all-time record, increasing 15% over the first quarter consumption of 1952. Synthetic rubber consumption continued to be 65% of the total as in 1952 *(11)*. Production figures for the first five months of 1953 showed a slight increase, about 5%, in synthetic rubber output, and a 5% decrease in natural rubber production, compared with the first five months of 1952. Consumption for this period in 1953 for both natural and synthetic rubber increased over the first five month period of 1952 *(12)*. Oil-extended and cold GR-S showed increases in consumption in 1952 over 1951, while regular GR-S consumption decreased *(13)*.

Since June, 1952, the price of natural rubber has decreased from 30c per pound to 21½c per pound in August, 1953 *(14, 15)*. The price of synthetic rubber has remained at 23c per pound since March, 1952 *(16)*. In July, 1953, the price of Butyl rubber was increased from 20¾c per pound to 23¼c per pound. The lower price had been in effect since December, 1950 *(17)*.

Cold Rubber Developments

Whereas regular GR-S, or "hot rubber", is manufactured at 122° F., so-called "cold rubber" is manufactured at 41° F., requiring refrigeration equipment. About 55% of the total GR-S now being produced is cold rubber. Cold GR-S has higher tread-wear resistance even than natural rubber, but natural rubber still develops less heat and is better for carcass stocks.

Several modifications of the compounding and manufacturing processes for cold rubber have been developed. A new fast process utilizes an extremely active hydroperoxide catalyst and stainless steel pipeline reactors, whereby butadiene and styrene can be polymerized 50 times as fast as by the conventional process, at the usual cold-rubber temperature of 41° F. Polymerization by the new process requires only 15 to 20 minutes, instead of the 10 to 12 hours now required. After polymerization, the latex is coagulated, filtered, washed and dried just like regular GR-S. The quality of the polymer produced is comparable to that of standard cold rubber, and has the advantage of a savings in capital investment over a conventional GR-S polymerization system. It is estimated that one commercial unit can produce as much as 24 conventional autoclaves *(18, 19, 20)*.

A further development of this particular accelerated process is its application at 122° F., producing GR-S comparable to regular "hot rubber" while retaining the advantages of speed and installation cost economies *(21)*.

A new chemical activator that is claimed to reduce the manufacturing costs of cold GR-S, to speed up its production and to make a more uniform product has recently been announced. This material has been named only as "a sulfoxylate derivative". Laboratory tests indicate the rubber may have better aging characteristics than present types due to low iron content *(22)*.

An outstanding development of 1952-53 is the extension of cold rubber with rosin, in a procedure similar to that employed in extending GR-S with petroleum oils. Laboratory tests on tire tread and carcass vulcanizates have shown improvement over corresponding regular cold rubber vulcanizates in a number of respects, i.e., as much as 50% better Lambourn abrasion resistance, up to 30% higher tensile strength at room and elevated temperatures, up to 15° lower temperature rise on flexing, superior flex cracking resistance, and superior aging resistance *(23, 24)*. Two papers that discuss recent technical advances in the field of low temperature polymerization have been published *(25, 26)*.

Carbon black can be readily dispersed in GR-S rubber by being jetted into the latex with a high-pressure steam jet. The new process is said to reduce both initial and processing costs of the rubber. In an 18,000 mile road test, tires produced from the steam-jet cold GR-S showed a 20% improvement in tread wear over control tires of the best cold GR-S produced by other methods *(27, 28)*.

The results of a study of the effects of a number of polymerization variables on the tensile properties of films from cold GR-S latex should be useful in the production of improved synthetic latex films *(29)*.

Note: This report was presented before the Rubber and Plastics Division, American Society of Mechanical Engineers, New York, N. Y., November 30, 1953.

Developments in Other Elastomers

Oil-extended GR-S: Oil-extended and plasticized GR-S, a development of 1951, is made by adding substantial proportions of petroleum oils to the synthetic latex before coagulation, resulting in a material equal to or superior to other types of rubber at a lower production cost. This type of rubber, when properly compounded, gives tread wear as good or better than cold GR-S. Studies indicate that the chemical composition of the oils used as extenders may have pronounced effects on some of the physical properties of the oil-enriched rubbers. These oils may have a wide spread in chemical composition and physical properties and therefore an oil should be selected to give the best over-all balance of properties desired in the final rubber product. Compatibility, processibility, and low temperature properties are the most important factors to be considered *(30, 31)*.

Nitrazole Rubber: Another type of GR-S synthetic rubber comparable to cold rubber and superior to regular GR-S in physical properties can be produced in non-refrigerated equipment, at 122° F., with the aid of a polymerization catalyst, Nitrazole CF (p-nitrobenzene diazonium p-chlorobenzene sulfonate). Both nitrazole rubber, as it is called, and cold rubber have good abrasion resistance. Road tests of nitrazole rubber have shown promising results. The improved properties of the synthetic apparently stem from a superior molecular weight distribution achieved by the catalytic rather than low temperature polymerization. The use of this polymerization system eliminates the expense of refrigeration equipment, and Nitrazole CF is no costlier than other catalysts being used at present *(32, 33, 34)*.

Alfin Polymers: Alfin catalysts offer a distinctly new method of producing a very tough synthetic rubber, which previous studies have shown to have some properties superior to GR-S. A general description of Alfin rubbers has been published. Alfin rubber compounds show, in general, superior abrasion resistance, very high flex life, and excellent aging properties. The polymer has the interesting property of being set or vulcanized by heat without the necessity of incorporating sulfur *(35)*. Polymerization and copolymerization reactions with Alfin catalysts have been studied in order to lay a firm foundation for pilot plant development of the process. At the present time, Alfin polymers are still in the laboratory stage *(36)*.

Vulcollan: The properties of Vulcollan, a polyester rubber developed and marketed in Germany, are said to be better than the properties of the conventional natural and synthetic rubbers. However, Vulcollan is difficult to process, and is rather expensive. The synthetic rubber is a condensation polymer of glycols and adipic acid. Vulcollan is said to be well suited to the manufacture of heels, insoles, solid tires, cycle tires, and cable covers. Heels made of Vulcollan have been reported to wear about 10 times as long as heels of natural rubber *(37, 38, 39)*.

Chemigum SL: A polyester synthetic rubber similar to Vulcollan but without the processing difficulties has been developed in the United States. Chemigum SL, as it is named, has tensile strength of well over 5000 pounds per square inch without carbon black, good resistance to abrasion and high tear strength. This synthetic is a condensation polymer of a low molecular weight polyester adipate with a diisocyanate, and can speedily be vulcanized. The new rubber is supposed to hold air like Butyl, to have oil resistance like neoprene, and to have oxidation resistance superior to that of natural and other synthetic rubbers. According to reports, tire treads of Chemigum SL show two to five times greater wear resistance than those made from the best cold GR-S. However, until the non-adherence of the new synthetic to other rubbers is overcome, its use as a tough skin for tire treads cannot be realized. Other potential uses are as heels, soles, and conveyor belts, and as protective coatings for heels, soles, belt surfaces, floorings, etc. *(40, 41, 42, 43)*.

Hydropols: A series of thermoplastic hydrogenated polymers, Hydropols, have outstanding freeze point, oil resistance, and tensile strength. These materials result from the hydrogenation of synthetic elastomers such as polybutadiene and copolymers of butadiene with various vinyl compounds. Hydropols are flexible at very low temperatures; for example, hydrogenated polybutadiene can be struck sharply at —100° F. without shattering and is not brittle (even though extremely hard) at liquid nitrogen temperatures. Some of the more important potential applications are in wire and cable coating, films, tubing, and various molded items *(44)*.

Hypalon: Further investigations of Hypalon (chlorosulfonated polyethylene) show exceptional resistance to chemical and solvent action, to the effects of oxidizing agents, to absorption of liquids, and to attack by ozone and oxygen *(45)*. The blending of small amounts of Hypalon with other elastomers results in an improved resistance to ozone degradation *(46)*. Blends of Hypalon and GR-S have also been investigated. GR-S blends containing 25% or more Hypalon give tread stocks with improved ozone and abrasion resistance, as well as improved heat aging characteristics. However, the development of a suitable curing system for these blends presents unusual problems because of the differences of the chemical structures of the individual elastomers. Field evaluations of these blends have been started *(47)*.

Hard Rubber: High styrene resins are well known for their hardening and stiffening action in soft rubber compounds. This same principle has now been applied to hard rubber stocks with equal effectiveness. Blends of high styrene resins and hard rubber compounds give products with improved impact strength and appearance. Processing and preforming of the resin stocks are said to be improved also. By using the resins to promote a portion of the hardening and stiffening action in the hard rubber compound, it is possible to reduce the sulfur content of the compounds *(48)*

Ebonite articles manufactured from latex are said to have mechanical properties superior to those from corresponding dry rubber mixtures. These superior mechanical properties are ascribed to the fact that in latex processes the rubber molecules have kept their original length. Steel can be coated with latex ebonite, and the same adhesion is obtained as with the conventional ebonite solution. Latex ebonite can be applied as an anti-corrosion coating for metal parts of intricate shapes, such as stirrers, baskets, turbines, etc. It is claimed that latex ebonite articles are generally less expensive than dry rubber ebonite products *(49, 50)*.

Reclaimed Rubber: A new kind of reclaim in powdered form has been introduced. The powder is free flowing and suitable for automatic handling. A variety of these reclaim powders can be produced, in a wider range of plasticities than is possible by the use of conventional reclaiming equipment *(51)*. A practical process has been developed for reclaiming ground rubber scrap by using microorganisms for the removal of cellulosic material, yielding neutral reclaim of good quality at low cost *(52)*. Improved reclaiming methods for obtaining fiber-free reclaim from tire rubber have been discussed *(53)*. The discoloration of light-colored stocks due to migration of staining materials from reclaimed rubber in adjacent stocks, as in white sidewall tires, can

be reduced by incorporating active carbon in the reclaim *(54)*.

Miscellaneous Types: A new series of fluorocarbon rubbers are said to have good high-temperature stability, and excellent resistance to attack by ozone, fuels, lubricating oils, hydraulic fluids, etc. They are polymers of dihydroperfluoroalkyl acrylates, and are easily vulcanized. The properties of these new rubbers recommend them especially for automotive and aircraft applications *(55, 56, 57)*.

Another rubber suitable for aircraft applications results from the addition of a mineral filler, mostly clay, to nitrile type synthetic rubbers. This filler serves to reduce the swelling of the compound when immersed in aviation fuel, and also improves electrical properties and elevated temperature resistance. The rubber can be bonded to metal with the usual rubber-phenolic adhesives *(58)*.

A general description of the requirements for rubber-like materials for the newer jet bombers and supersonic fighter aircraft has been published *(59)*.

Studies show that the oil resistance of nitrile rubber vulcanizates depends primarily on the butadiene-acrylonitrile ratio. As acrylonitrile content is increased, oil resistance decreases *(60, 61)*.

The tensile and elongation properties of silicone rubbers can be approximately doubled by the incorporation of ultra-fine silica pigments. The new compounds are being used experimentally in automobile tires and V-belts *(62)*. The superior low-temperature characteristics of silicone rubbers in comparison with natural and GR-S rubbers have been demonstrated. In a study of low-temperature behavior, the silicone rubbers did not show appreciable stiffening until some temperature between —112° and —130° F., while natural and GR-S rubbers were stiff at —76° F. *(63)*.

The acrylate rubbers possess outstanding resistance to oils and have high temperature-resistance second only to the silicones. Copolymers of acrylates with acrylonitrile have somewhat better physical properties than earlier types, while retaining their advantages *(64)*.

Butyl rubber has almost completely displaced natural rubber for pneumatic inner tubes *(65)*. Leather impregnated with Butyl rubber provides soles which have the same greatly improved abrasion and water resistance as leather which has been impregnated with natural rubber. In addition, the use of Butyl rubber reduces the time required for the milling operation and also saves time, labor, and materials in the tannery *(66)*.

In tests over a ten-year period, properly compounded neoprene vulcanizates have shown creep resistance equal to or better than that of natural rubber vulcanizates *(67)*.

Product Developments

Tires: Techniques for the measurement of tread wear of commercial tires have been improved by studies at the National Bureau of Standards. The most efficient method was found to be the weighing of the complete tire on a sensitive balance. Results show that reliable estimates of tread life can be made from 4000 to 6000 miles of road test using the improved techniques *(68)*.

The development has been described of a tire tester which evaluates resistance to flexing fatigue and cut-growth, running temperature, and tread life, all of which heretofore required separate testing. The tester track is 1/60ths of a mile in circumference and will accommodate 18 tires simultaneously. It can be regulated to speeds between 22 and 66 miles per hour *(69)*.

An investigation of the effect of test severity on the relative ratings of natural rubber, regular GR-S and cold GR-S tread compounds shows that the rate of wear is affected very greatly by the severity of the test. Both laboratory and actual road wear performance data show that synthetic rubber and natural rubber are fairly similar in rate of wear under mild conditions of testing, but in severe service the synthetic rubbers are vastly superior to natural rubber *(70)*.

The winter driving behavior of tires made of natural rubber and synthetic elastomers has been studied. Results show that natural rubber tires have better traction and acceleration on snow and ice, but that some synthetic elastomers are superior on wet pavement and turning corners on ice *(71)*.

To study the skidding of automobile tires, a machine consisting of a circular aluminum ice tray that turns under rubber test blocks measures the amount of friction between the rubber and the ice. Results show that temperature has the greatest influence on tire friction on ice. At the lowest test temperature, from about —22° to —40° F., the coefficient of friction is just about twice its value at a temperature just below freezing. The kind of rubber and its hardness also affect friction *(72)*.

A new term, "abrasion pattern," describes the array of nearly parallel ridges produced by abrasion on rubber surfaces. The ridges run at right angles to the direction of abrasion, and their profile is asymmetrical with respect to the direction of abrasion. This "abrasion pattern" has been used to explain the mode of abrasion of tires *(73)*.

A test machine claimed to be the fastest of its type in the world has been developed to reproduce landing, taxi and take-off conditions of airplane tires of present and prototype jet aircraft up to 3000 revolutions per minute, with a maximum speed of 300 miles an hour. It tests tires ranging in size from 17 to 37-inch tread diameter under loadings up to 8 tons *(74)*.

A new test procedure for measuring tire cord fatigue resistance shows good agreement with actual tire performance data. Studies show that loss in tire cord strength stems from broken filaments and from a small loss in fiber strength throughout the tire, and not from abrasion or heat degradation. The Goodrich disk-type tester showed the same relative rate of strength loss for rayon and cotton cords as was found in a passenger tire fleet test *(75)*.

Mechanical Goods: A new "flowed-in" gasket which is applied as a liquid synthetic rubber or resin compound and then baked to a solid rubbery gasket is said to provide an improved seal at lower labor and material costs. The gaskets can be made in varying formulations, types, thicknesses and diameters *(76, 77)*. Two articles on the continuous vulcanization of cables have been published in the past year *(78, 79)*.

On the basis of laboratory tests, sodium-catalyzed polymers, because of their good electrical properties, would be useful for wire and cable stocks. The properties of these polymers are superior in some respects to the properties of polymers now being used for wires and cables *(80)*.

Coatings: A symposium on emulsion paints which was presented before the Division of Paint, Varnish, and Plastics Chemistry at the 122nd meeting of the American Chemical Society in September, 1952, covered the chemistry and technology of the so-called latex- or rubber-based paints *(81-90)*. The growth of latex paints can be seen in an estimated doubling of production each year since 1949 *(91, 92)*.

Over a dozen protective coating systems for steel which offer excellent protection against distilled and sea water and against solvents have been developed using Thiokol polymers as the basic chief constituents. An accelerated method of performance testing was devised

to test resistance to distilled water, synthetic sea water, and a synthetic sea water-SR-6 test solvent mixture *(93)*.

It has been found that a synthetic rubber-based paint, designed to cover tiny surface variations with a smooth aerodynamic film, is pushing up jet aircraft speeds. The paint is formulated to resist attack by aromatic fuels and rain erosion at high speeds *(94)*.

A new product made of liquid synthetic rubber and dry cement is claimed to make cement last indefinitely. The coating, called "Surco," is said to have excellent adherence to steel, glass, wood, stone or concrete, to stand up under vibration or impact, to take colors and polishing for ornamental floors or walls, to preserve the steel that reinforces concrete, and to prevent damage by moisture *(95)*.

The biological deterioration of polysulfide polymers used as linings for underground gasoline storage tanks has been found to be due to the action of molds and bacteria, which enter the tanks from the soil. The addition of pentachlorophenol to the polysulfide latex dispersion from which the linings are prepared is an effective method of control *(96)*.

Pavements: Studies being conducted by the U.S. Air Force indicate that most of the injury done to bituminous pavement by fuel spilled from jet airplanes can be avoided by using coal tar with which synthetic rubber has been blended as a binder for such pavements *(97)*. The "rubber roads" program being sponsored by the Natural Rubber Bureau was continued in 1952. Installations have been made in 19 states, and 3 provinces of Canada *(98)*.

Adhesives: A number of generally satisfactory one- or two-coat organic cements are available for securing adhesion of rubber to steel; however, where a high-strength durable bond is required, as in motor mounts, much of the industry has continued to rely on the combination of brass plate and adhesive. An investigation concerned with the development of a one-coat replacement for the brass-plate system has shown that a new series of diene-unsaturated acid copolymers possesses exceptionally high adhesion to rubber and steel *(99)*.

A new silicone product, Silastic XC-270, compares favorably with conventional pressure-sensitive adhesives at room temperature. It retains its high adhesive strength at temperatures ranging from —55° to over 300° F. *(100)*.

Other Applications: Possibilities exist for the use of considerable quantities of rubber aboard ships in various decking applications, such as synthetic rubber matting, standing mats, latex-mastic compounds, and seam calking *(101)*.

Testing and Evaluation

A dynamic apparatus has been developed for the accelerated evaluation of ozone-protective agents for elastomers. By a simplified rating system a non-technical person can rate a large number of specimens rapidly and without elaborate equipment. The method has been found to give results which correlate well with outdoor tests *(102)*. The quantity of ozone absorbed by rubber can be determined by a new method and apparatus. This method can be used also to study the reaction of ozone with antioxidants *(103)*.

The depth of attack of ozone upon rubber articles is influenced by such variable weather factors as moisture, temperature and light. In a study of the influence of ozone exposure temperature on the depth of ozone attack (at an ozone concentration of 25 pphm) it was found that, in the range of —20 to +60° C. the most severe ozone attack took place at 40° C. Light was found to decrease the extent of ozone attack on a compound under either static or dynamic elongations. Depth of ozone attack is at a minimum at optimum cure *(104)*.

The effect of mineral oil swelling agents on the stress-relaxation properties of various rubbers has been investigated. The results show that continuous stress relaxation is inhibited by the presence of oil, and that unconfined swelling measurements predict the degree of inhibition directly. The swelling characteristics of the different elastomers in oils is of importance in their use for O-rings and other types of gaskets which undergo compression in service *(105)*.

By the use of radioactively labeled gases containing carbon-14, it was found that the differences in permeability of natural and some synthetic rubbers are due mainly to the differences in the rate of diffusion and only slightly to the differences in solubility and rates of evaporation *(106)*.

A new method and apparatus studies the oxidation and aging of elastomers by partial oxidation in solution in a sealed autoclave at 198° C. Three hours in the "water bomb" at 198° C. are said to be equivalent to 192 hours in an oxygen bomb at 80° C. *(107)*.

A simple test for the quantitative measurement of the flexibility of rubber products has been devised. The equipment is inexpensive and can be home-made *(108)*. For flex-cracking and crack growth tests, the DeMattia test has been chosen for international standardization *(109)*.

The adhesive strength of bond of rubber materials to metal can be measured by a newly developed rubber strip adhesion tester. This apparatus is used in measuring the force required to separate a rubber strip from a metal base at a definite jaw separation speed and with the separating force applied at right angles to the base, thereby providing reproducible test conditions *(110)*.

It has been found that the reliability of Mooney viscosity measurements can be improved by a few changes in design and technique. It is recommended that: (1) radial V-grooves replace the serrations on the rotor and dies; (2) chromium plating of the rotor and dies be eliminated; (3) die and die holder be constructed as an integral unit, and (4) the speed of the rotor be reduced to 0.1 r.p.m. or less for rubbers having very high molecular weights *(111)*.

An apparatus and method for studying the behavior of motor mounting compounds under continuous shear load and with simulated service conditions has been described. Serviceability is judged by two parameters: the amount of creep under continuous load, and the change in tangent modulus *(112)*.

The use of a quick-acting wrench as an alternate for the conventional bolted steel plate device in determining the low-temperature set properties of elastomers has been investigated. The quick-acting wrench compression set apparatus has been found to be superior to the screw-type device with respect to duplication of compression set ratings, accuracy of short time (10-sec.) compression set values, and ease of manipulation *(113)*.

A laboratory machine for use in buffing strip samples of rubber materials has been modified so that rough strips having maximum dimensions of 24 inches by 1¼ inches by ½-inch can be buffed to a predetermined thickness with a tolerance of 0.001-inch over the entire buffed surface *(114)*.

Each year many new and different applications of rubber appear. With the development of new and better synthetic rubbers and the improvement of older types of rubbers, there seems to be no end to the possible uses of rubber.

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Studies of the Mooney Viscometer at the National Bureau of Standards

RECENT investigations at the National Bureau of Standards have led to a better understanding of the utility and limitations of the Mooney viscometer—an instrument widely used for quality control in synthetic rubber production and in rubber processing. In the course of these studies, which were sponsored by the Reconstruction Finance Corporation, G. E. Decker and F. L. Roth of the NBS rubber laboratory have developed designs for the viscometer rotor and dies which provide improved dimensional stability, better heat-transfer characteristics, and much greater uniformity of results. Rotors and dies constructed to the Bureau's specifications have been placed on trial in synthetic rubber plants and by rubber manufacturers with a view toward their eventual standardization.

The Mooney viscometer, invented in 1933 by Melvin Mooney of the United States Rubber Company, consists of a disk rotating in a shallow cylindrical cavity filled with the rubber under test. The rubber is squeezed into the cavity under considerable pressure. The surfaces of the disk, or rotor, and of the dies which form the cavity are serrated in a grid pattern to grip the rubber mechanically. The force required to rotate the rotor at a constant rate—ordinarily 2 rpm—is measured by deflection of a calibrated spring and is proportional to the mean viscosity of the rubber in arbitrary units. The viscosity is obtained at an elevated temperature, generally 212°F., the instrument being heated either by steam or electricity.

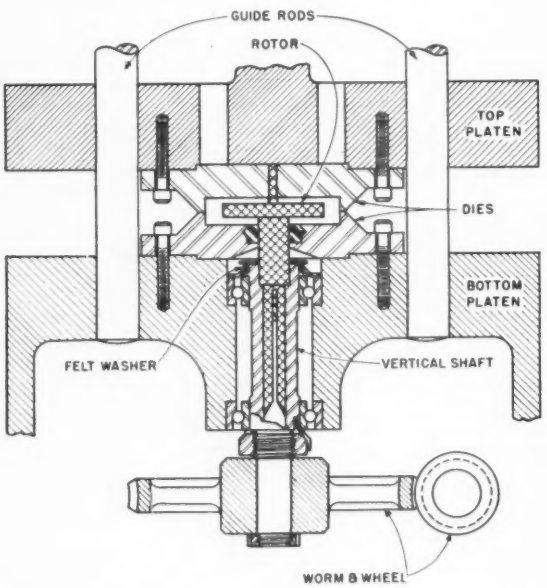

FIG. 1—Cross section of the improved NBS model of the Mooney viscometer. Closure of the die cavity forces the rubber to surround the rotor and completely fill the cavity. With the specimen thus held under pressure, the rotor is driven at a constant speed, and the torque required to shear the rubber between the surfaces of the rotor and the die cavity is measured by the deflection of a calibrated spring. The reading of this deflection at any instant is taken as the Mooney viscosity.

When the Government's synthetic rubber program started in 1942, the Mooney viscometer had not been standardized sufficiently to become a practical tool for the rubber industry; results with a given instrument were not reproducible, and serious disagreements were found in the results obtained in different laboratories. The Office of the Rubber Director therefore requested the National Bureau of Standards to develop a standard procedure of operation, to standardize the dimensions of the parts, and to improve the design of the viscometer. Intensive studies at NBS resulted in the standard NBS model of the Mooney viscometer, which has been useful for quality control and for measuring the properties of natural and synthetic rubbers. Also, during the past decade, the Bureau developed standard procedures for measuring viscosities of synthetic rubber, devices for automatic recording, a mechanism for measuring recovery, means for better control and measurement of temperature, and procedures for adjustment and calibration. Much has also been learned concerning the rheology of rubber, which exhibits elastic as well as viscous behavior.

More recently, problems arose as a result of the commercial production of synthetic rubbers having higher molecular weight. Also, several plants reported that different commercial rotors yielded different viscosities for the same rubber. At the request of the Office of Synthetic Rubber of the Reconstruction Finance Corporation, NBS undertook an investigation of these difficulties and studied the influence of variations in rotors, dies, and rate of shear on Mooney viscosity.

Two Mooney viscometers were used in the investigation. The Mooney viscosities, or viscometer readings, for both machines were automatically recorded on charts. A d-c motor and an electronic control were used in combination with mechanical speed reducers to obtain various rotor speeds. Several rotors having different thicknesses and having serrations of different depths were employed. The dies were of hardened tool steel. One set of dies was supplied commercially and had serrations about 0.015-inch deep. The other set had no serrations and was designed so that the die and die holder were made from a single piece of metal. The depth of the specimen cavity formed by the smooth dies was made slightly greater than that formed by the commercial dies in order to obtain equivalent viscosity readings. Viscosities of several rubbers and rubber compounds were measured with each of the rotors and with each of the two sets of dies.

Although the commercial rotors did not meet the dimensional tolerances specified for eccentricity and perpendicularity of the rotor head to its axis, these variations were not responsible for the differences noted in the results. Instead, it was found that variations

in the serrations, for which there were no tolerances, had a pronounced influence. Two reasons for this were apparent. First, the serrated design permits rubber to slip or shear along the portions of the grooves which are in line with the direction of motion. Second, the pinnacles at the edges of the rotor are easily broken, resulting in a change in rotor dimensions. These observations led to a study of smooth rotors and dies.

For most commercial rubbers, the smooth parts were found to be satisfactory. However, recently produced rubbers having higher molecular weights slipped more on the smooth than on the serrated surfaces. It was found that slippage of these higher-molecular-weight rubbers depended not only on the mechanical nature of the surface but also on the chemical nature of the surface and the speed of the rotor. Slippage was greatest on cadmium- or chromium-plated surfaces and least on surfaces coated with gold, silver, or a metallic sulfide.

On the basis of these observations, steel rotors and dies were designed in which the usual serrations were replaced by radial V-grooves. A layer of iron sulfide which formed on the surfaces during initial tests of rubber compounds reduced the tendency to slippage. In this type of design the depth of the grooves is not critical because the grooves are always perpendicular to the direction of motion and the rubber cannot slip or shear along them. The dimensions of the rotor are also more stable because there are no small pinnacles at the edge which can break off or wear rapidly. The relatively large smooth areas and V-grooves contribute to greater ease in removing the sample and cleaning the metal surfaces. In addition, the V-grooves permit the die and die holder to be fabricated as an integral unit. This integral design increases the rate of transfer of heat from the apparatus to the rubber so that steady state conditions are reached sooner.

The improved design also includes a thermocouple well in the die for use in measuring its temperature. Studies conducted by G. E. Decker and R. D. Stiehler, also of NBS, indicate that the customary methods of measuring temperature, either by mercury-glass thermometers in the platens used to press the dies together or by a thermocouple inserted through a metal tube in the rubber, are not reliable. Although a knowledge of the rubber temperature is particularly important in the determination of vulcanization characteristics, there is no practical means of measuring it directly. The best alternative is to measure the temperature of the dies which form the cavity enclosing the rubber.

In the case of rubbers having very high molecular weights, slippage in the viscometer could not be prevented by any known mechanical or chemical means under the standard method of operation. For many of these rubbers, it was found that slippage could be avoided by reducing the speed of rotation of the rotor. However, at very low speeds the accuracy of the measurements is impaired because the torque on the rotor is so small that it is comparable with the frictional forces in the viscometer. Also, the time involved in determining the viscosity becomes too great for control testing. The NBS studies showed that at a rotor speed of 0.1 rpm the time required to obtain a reliable reading is not excessive and the frictional forces are still small compared to the torque on the rotor. The practical usefulness of the Mooney viscometer is thus limited to rubbers that do not slip at 0.1 rpm. Results for rubbers of extremely high molecular weight, requiring even slower rotation of the rotor to prevent slippage, must be interpreted with caution.

FIG 2—Two steam-heated models of the Mooney viscometer were employed by the National Bureau of Standards in its study of the effect of variations in rotors, die surfaces, and rate of shear on the operation of the instrument. Data were recorded automatically at right. Rubber specimens for test are visible in the left foreground.

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Improvements and modifications designed to increase efficiency have been made on all **permanent magnetic drums** produced by the Eriez Manufacturing Co., Erie, Penna. Among the many improvements incorporated in the new magnetic drums are changeable sheave sizes for various operating speeds, stainless steel shells that resist pitting and corrosion, dust-tight construction, light-weight, rigid, cast aluminum sides, adjustable feeder assemblies, smooth running and oil-sealed bearings, and extended discharge ducts.

Unusually close control is said to be offered by a new **stepless temperature control** developed by the West Instrument Corp., 525 No. Noble St., Chicago 2, Ill. The new unit differs from ordinary types in that it has no relay and supplies only enough power to the heating element to hold the temperature for which it is set. The heater only operates at full power on the initial temperature rise.

Editorials . . . . . .

Rotation Policy

IN ACCORDANCE with the suggestion made by the Management Committee of the International Rubber Study Group and subsequent consultation with its own Rubber Business Advisory Committee, the General Services Administration on December 9 made a basic change in its rotation plan on natural rubber. Specifically, it cut rotation of the national stockpile from 10,000 to 5,000 tons per month, as reported in our previous issue. This action was taken to bolster the price of the lower grade rubbers and to give a psychological uplift to some of the rubber producing nations, particularly Indonesia. Actually, the change will take full effect on April 1, when present future orders are completed.

At the time the new plan was announced, Edmund F. Mansure, GSA Administrator, indicated that the market for natural rubber, particularly the lower grades, might or might not feel the effects of the new plan immediately. To date, some four weeks after the announcement, the plan has resulted in substantially narrowing off-grade differentials, although the price of No. 1 Ribbed Smoked Sheets has remained fairly constant in the 20-21 cent range. For example, as pointed out in the current issue of *Natural Rubber News*, the discount for No. 3 RSS, which has been hovering around 2 cents a pound, declined to ¾ cents by the middle of December, the lowest experienced since March, 1950, while the discounts for No. 2 Brown and Flat Bark declined about 1 cent a pound.

Although details concerned with the rotation program are not public information, particularly where various grades are concerned, it is believed that a large portion of the 10,000 tons per month which GSA has been rotating consisted of Browns, Ambers, Flat Bark and Smoked Blankets. Obviously, as the Natural Rubber Bureau points out, a reduction in the disposal rate of these grades is bound to reflect a favorable price improvement for them. Such an improvement is especially welcomed by the smallholders of both Indonesia and Malaya who are responsible for the bulk of the off-grade rubbers. Demand for these off-grades will increase still further after April 1 when only 5,000 tons of rotation rubber will be available per month. This demand should have a decided effect on the price of not only the off-grades but of No. 1 RSS itself.

At this writing, GSA officials are again conferring with members of the Rubber Business Advisory Committee to make further changes in the rotation plan, presumably to still further strengthen current prices of natural rubber. We are in agreement with such moves, because by this time it should be evident that some of the rubber producing countries, such as Indonesia and Ceylon, will not wait forever upon the free world but will turn to Communist China and other Communist satellites to bolster their economies. Granted that such talk is in accord with the propaganda line of the rubber producers, but there are basic facts even in propaganda.

Guaranteed Wage

ALTHOUGH predictions at the beginning of a new year are apt to look a bit foolish in retrospect, we are willing to stick our necks out to the extent of predicting that labor wil make a serious drive during the calendar year of 1954 for a guaranteed annual wage, which is another way of saying guaranteed employment. Top labor officials have been hinting at such demands for several years, and several of them have issued flat statements on the subject. In the rubber field, the International Policy Committee of the United Rubber Workers is known to be making a study of the guaranteed wage with a view to getting it ready as a collective bargaining demand. The URW now has some 200,000 members.

Space limitations prohibit a complete discussion of the pros and cons concerning a guaranteed annual wage, but since organized labor has made it clear that such a wage will be its next major objective, management, both large and small, should acquaint itself with the numerous factors involved. The fact that there have been more than 350 guaranteed annual wage pacts in operation since 1946 may come as a surprise to some manufacturers, although there has been no concerted effort to have such a plan adopted industry-wise. However, such a plan is now afoot, and since the rubber manufacturing industry has long served as a "guinea pig" it would not be too surprising if once again it earned that dubious honor.

Trends and Review

Year-End Statements As Well As Predictions for 1954
Compiled by RUBBER AGE for Easy Reference

Another Good Year Predicted for the Industry

Consensus Indicates Good Prospects for Tire Industry in 1954 . . . Non-Tire Segment of the Industry Will Operate in a Highly Competitive Market . . . Companies Expected to Put Forth Increased Selling Effort.

THE trade is of the opinion that another good year is ahead for the rubber industry. In general, it is not expected that 1954 will be as good as 1953 when sales reached a $5,500,000,000 mark. Industry estimates show that sales may be 5 to 7% lower than in 1953, with total new rubber consumption in the United States running approximately 3% below the 1,340,000 long tons consumed in 1953. While sales of passenger car tires may drop somewhat in 1954, the portion of the market devoted to replacement tire sales may rise somewhat.

The market for foam rubber continues to increase rapidly. It is not expected that this growth will be slowed much in 1954, even with predicted cut-backs in automobile production. The supply of new rubber will be adequate and the price structure is expected to remain fairly stable. Rubber industry defense business declined about 12% in 1953 from 1952 figures. A further decrease of about 10% is expected in 1954. The rubber industry's chemical activities are expected to grow in 1954, with the outlook for plastics held to be particularly good. There follow below statements by leading industry figures on the accomplishments of the past year and predictions as to what may be expected in the current year.

Predicts High Level Activity . . . . .

P. W. Litchfield

THE rubber industry in 1953 consumed more rubber, sold more goods, gave its employees higher take-home pay and produced better tires than ever before in history. In every respect, the year was very satisfactory. Prospects are that 1954 will be another year of high-level activity, somewhat below 1953. Reduced production of new cars, trucks and farm tractors, which now seems likely, would result in a commensurate reduction in our original equipment tire business. But there is every indication that the sales of tires for renewal purposes will be higher in 1954 than in 1953. This is due to the fact that the large volume of new cars made in 1950, 1951 and 1952 will be coming into the market for replacement tires. In certain other segments of our business, the prospects are encouraging. Production and sales in films, foam and flooring are expected to gain. So, too, is the chemical end of our business.

Our post-war program of plant expansion and improvement has brought us to the point where we can produce more goods and operate more efficiently than ever before. There will be less capital expansion in 1954. The supply of new rubber will be adequate and the price of this commodity is expected to continue reasonable. This is a stabilizing factor of basic importance to the industry.

Sales effort is being stepped up through improved organization and personnel training. Competition will be stronger in the rubber business—not only in the United States, but in all parts of the world. This means that the consumer will get better values and better service. Of course these prospects could quickly be changed by unfavorable developments in world affairs but, assuming that nothing of this kind occurs, it now appears that 1954 will prove satisfactory in terms of production, employment and sales.

The over-all prospects for the rubber industry indicate continued growth over the next decade. This growth probably will not be in the form of a steady line from year to year, but the long trend is toward higher levels. This long term prospect, however, is beclouded by two serious factors. One of these is the condition of our highway system. It is inadequate to properly carry the present transportation needs of the nation, and we do not seem to be moving effectively to improve matters. It should be remembered that goods cannot be produced and sold unless they can be transported, and that we cannot add greatly to the present total of fifty-three million motor vehicles unless there are adequate highways on which the additional cars can operate.

Another deterrent to economic expansion is the continuing high level of government spending and taxation. The higher the tax load, the lower is the incentive to venture and the lower is the available supply of venture capital. Corrective measures should be taken before the point of acute danger is reached.

Tire Business Encouraging . . . . .

Harvey S. Firestone, Jr.

THE rubber industry had its best year in 1953. A record high in sales will exceed last year's industry sales of $5,233,000,000. Firestone, too, had its best year in 1953. For the first time its sales of products and services were more than one billion dollars. 1954 business prospects for tire dealers are very encouraging because there will be about one million more passenger cars, trucks and busses two or more years old than there were in 1953. This makes a total of more than 32,000,000 cars and 7,000,000 trucks on the road which are two or more years old. Although announced estimates for 1954 car and truck production have been somewhat lower than for 1953, the steadily increasing demand for replacement tires is expected to enable the rubber industry to operate at normal capacity levels during 1954.

Supplies of both natural and synthetic rubber were ample to

meet the requirements of the industry and there was less fluctuation in price than during 1952. The tonnage consumed was the highest in the history of our country.

There is growing confidence in the future of natural rubber, as evidenced by large-scale replanting programs in the Far East. This activity supports the opinion that I have so often stated on the basis of our experience with the Firestone plantations in Liberia, West Africa, that efficient plantations can be profitably operated in competition with synthetic rubber.

Congress enacted a law on August 7, 1953, providing for the sale of the Government-owned synthetic rubber-producing facilities to private industry. Actual transfer cannot take place before early in 1955. Our company has urged such action for many years, believing that both the industry and national security will benefit by greater competition as a result of private ownership. We continue to operate for the government synthetic rubber plants in Akron, Ohio, and Lake Charles, Louisiana.

Firestone plant capacity has been materially increased and manufacturing processes improved in all production divisions including passenger car, truck, tractor and earth-mover tires; Foamex, the foam rubber used for mattresses and upholstery; mechanical rubber goods; defense products; reclaimed rubber; Velon plastic fibers, and basic resins for plastics.

Manufacture of products other than tires and tubes continues to be the most rapidly growing phase of our business. In 1946 and the prewar years, non-tire rubber products used about 26 per cent of the total amount of rubber used by the industry. This year these products used about 35 per cent of the total. The biggest single reason for this increase in non-tire rubber consumption is the great demand for foam rubber products.

Our company continues to be an important supplier of defense products. Facilities for the manufacture of these items were extended and production was increased.

In 1953 Firestone continued to make recoilless rifles; cannon for tanks; anti-aircraft guns and mounts for naval vessels; gas masks; and component parts for tanks, military vehicles, aircraft and jet engines. Guided missile production was accelerated. Important contributions to the defense program were made by our advanced research and development work.

Firestone continues to operate the government arsenal at Ravenna, Ohio, for loading and storing munitions. Our former textile plant at New Bedford, Mass., was converted to the manufacture of artillery shells. This plant will be in full operation early in 1954. The company also is a major supplier of tires, tubes, rims and many other products for various Government divisions.

Prosperous Year Ahead . . . . .

H. E. Humphreys, Jr.

ANOTHER good year is ahead for the rubber industry. It will not be as good as record smashing 1953. But, compared with previous years, it will be a prosperous one for most people who have a stake in the industry. Sales of the industry, estimated at 5.5 billion dollars in 1953, may be 7% lower in 1954. Tons of rubber consumed in 1954 are expected to be the second highest in history, down only 4% from the record 1,333,000 long tons converted into finished products in 1953. On the basis of 1954 production forecasts by automobile manufacturers, fewer tires for new cars and trucks will be required. But replacement tire demand will be up 2½%. We look for sales of 77,000,000 passenger car tires and 13,000,000 truck and bus tires, for a total of 90,000,000. This compares with about 93,000,000 in 1953 and 85,000,000 in 1952.

Demand for industrial rubber products will continue good, although not as strong as in the past two years. Orders for these products follow closely the general level of industrial production. Increasing demand for power wire and cables, new types of transmission belts, plastic pipe and other plastic industrial products will partly offset any declines in other lines.

The market for foam rubber is increasing rapidly. We do not expect this growth to be slowed much, even by the cut-back in auto production. Added sales to the bedding and furniture markets will probably more than make up the difference.

Rubber footwear sales continue to follow a changing pattern. Waterproof footwear, which once accounted for the big bulk of business in this field, has declined in volume, partly due to recent mild winters. On the other hand, canvas, rubber-soled shoes for casual wear and sports have grown in public favor until they now make up roughly half of rubber footwear sales.

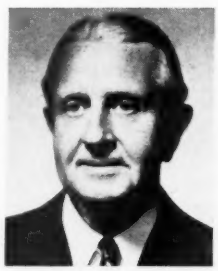
The industry's chemical business grows rapidly, and will continue to do so, particularly plastics. The outlook for reinforced plastics for car bodies, truck trailer bodies and as a building construction material is excellent.

In 1954, negotiations between the government and the rubber industry will decide the fate of the synthetic rubber plants. It is hoped that a suitable schedule for transfer of the plants to private industry can be worked out.

Rubber industry defense business declined in 1953 to 12½ per cent of total sales. A further decrease to about 10 per cent is expected in 1954.

Sees Lower Consumption . . . . .

John L. Collyer



PRODUCTION and sales of rubber products in 1954 may approach a level nearly as high as 1953, one of the best years in the history of the rubber manufacturing industry. The nation's 1954 total consumption of new rubber is expected to be about 3% below 1953's record of approximately 1,340,000 long tons. The United States will use about 1,300,000 long tons of new crude and synthetic rubber in 1954, with probably more than half of this coming from America's own synthetic rubber facilities. The rubber industry's outlook appears to be slightly better than current forecasts of the nation's over-all 1954 economy. I look to the past three years' high production of automobiles—many of which will need replacement tires in 1954—as one reason for the industry's outlook.

Over-all industry tire sales in 1954 are expected to approach 100,000,000 for the second consecutive year. This compares with the record in 1950 and an estimated 100,000,000 in 1953. Sales of replacement passenger car tires may be about 2 million more than the 47,000,000 sold during 1953, I believe, and total passenger car tire sales—replacement plus original equipment—may decline to 77,000,000 from 1953's sales of about 80,000,000.

Further growth in 1954 in motorists' use of tubeless tires is indicated. B. F. Goodrich, which introduced the tubeless tire in 1947 and which has basic patents on the tire, is negotiating with a number of other companies to license the manufacture of additional brands of tubeless tires.

Substantial capital investments were made by B. F. Goodrich in 1953 to enlarge facilities for the manufacture of tubeless tires. The company in 1953 established a new high in tubeless tire production and sales, and B. F. Goodrich has introduced for sale a new lower-priced tubeless tire for passenger cars. The company in 1953 announced the manufacture of tubeless tires for aircraft and introduced two new premium tubeless tires for distribution by its associated tire lines.

I predict further acceptance and installation of moving rubber belt sidewalks. B. F. Goodrich's installation of the world's first moving rubber sidewalk in its "Story of Rubber" exhibit at the Chicago Museum of Science and Industry last February has been followed by suggestions to use this new form of transportation for airline, bus and railway terminals, super markets, baseball

parks, busy street intersections and industrial buildings.

Congressional and Presidential action in 1953 directed toward the sale of the government-owned synthetic rubber plants was among the most significant events in the postwar history of the rubber industry. The ends of national security will be best served when this important part of the total industry is finally restored to private enterprise. This is particularly true in the light of the apparent need for the expansion of man-made capacities before 1960 to meet constantly increasing world demands for rubber.

The B. F. Goodrich Chemical Co. last year began operation of a new $6,000,000 plant for the production of chemical raw materials at Calvert City, Ky., and started construction of an $8,500,000 acrylonitrile plant there. The company also opened regional distribution centers at Seattle and Los Angeles and began construction of distribution centers at Columbus, Ohio, Indianopolis, Ind., and Springfield, Mass.

One of the most important improved products introduced by the company in 1953 was an all-nylon cord truck tire which has given truckers more than 100,000 miles of actual road service before recapping.

During 1953 the company formed two additional integrated divisions—its Tire and Equipment and its Industrial Rubber Products Divisions—with sales and manufacturing combined under a president and appropriate officers in each division. All manufacturing and sales activities of the company are now conducted in a total of six integrated divisions. This has been done to gain advantages of decentralized operations and to permit the training and development of management personnel needed to carry out further expansion of the company.

Hard Selling Ahead . . . . .

J. P. Seiberling

PROSPECTS for 1954 in the tire industry are good. Measured against 1953 results, there will be a small drop in total output—probably not more than 4% at the most. The industry almost certainly will ring up one of its three greatest years of tire sales. Only in 1950 and 1953 were more tires sold than we expect to ship in 1954. In the replacement tire market, despite every indication of continued high demand, 1954 should be another year of "hard sell." Besides normal replacement tire turnover, millions of vehicles built in the record years 1950 and 1951 will need tires for the first time, and gasoline consumption and registration statistics show that people are driving more miles than ever before. In fact, we expect that the rubber industry will sell more tires in the replacement market in 1954 than ever before in one year, except for the unusual postwar years 1946 and 1947, when we were satisfying pent-up wartime demand.

Why, then, will competition be keen? Because an expected decline in production of new cars and trucks will, in turn, cause, a drop in demand for tires in the original equipment market. Tire makers affected by this loss of volume will attempt to make it up in the replacement market. Paradoxically, one reason for the decline is that the product is giving better service. Technological improvements and a trend toward special-purpose tires have resulted in more miles per tire, and slower replacement sales.

Over-all, the sharpest sales contraction will come in the military tire field, but the number of units is relatively small. More significant is the drop expected in civilian original equipment tire sales, which should be about 15 per cent below the 1953 level.

On the brighter side, replacement sales of passenger and truck tires should be up about 5 per cent, from the 57,000,000 sold in 1953 to almost 60,000,000 in 1954—or about one replacement tire to be sold for every car and truck registered in the United States.

Prospects for Seiberling Rubber Co. are good, for we have strengthened our position in the replacement field by improving our methods of distribution, and, in addition, are beginning a long-range program of product diversification to level out the peaks and valleys of the tire business.

Challenging Business Climate . . . . .

William O'Neil

AMERICAN industry should forge ahead in the challenging business climate of 1954 through augmented selling and dollars plowed back into research. Renewed service selling doubled with new products coming from the laboratory will form a barrier against recession. Salesmen are going to have to get back to selling to meet the test of this transition period, I believe. Pounding the pavements and ringing doorbells will replace accommodating the customer by selling him your product. And the competition of increased selling will also inject new life into the national business picture. As far as research is concerned, our company invests more than $5,000,000 annually to improve present materials and products, and to discover new product applications in virtually every consumer field. An expanding research activity began for many companies as a convenient method of benefiting from tax deductible dollars. Now it is paying off handsomely in new products pouring out of American laboratories to open up new business ventures and beef-up the nation's economy.

This spur to new product development contrasts sharply with the English situation where concerns have been permitted to invest only as much in research as they did the previous year. Thus, when wages increased and the value of the pound decreased, deductible capital available for research dwindled to a trickle.

General Tire, the world's fifth largest rubber company, just closed the books on its 38th year of operation. Final figures will not be available until February, but sales and earnings hit an all-time high of approximately $210,000,000 in sales, and earnings of about $6 a common share. Heading into 1954, the company stands in a prominent position to capitalize on the expected banner year in replacement tire sales, and to push forward its activities in plastics, chemicals, mechanical goods, foam rubber, rockets, radio and television.

Businessmen used to remark that this is the age of specialization. General has been the forerunner in a trend to make this also the age of diversification as we learn more about products by branching afield. In fact, we're now pushing the theme of specialization through diversification.

Horizons are unlimited in plastics, and General should triple its volume in this activity next year.

Our chemical division should also step into seven-league boots next year, with completion of the Ashtabula polyvinyl chloride plant, which will produce the resin for our plastics operations, thus lowering the cost of this basic raw material.

The future is bright in mechanical goods as new molded and extruded products hit the market and the demand soars. And the potential growth of our rocket and guided missile activities can only be calculated by the mathematical wizards who have developed them.

General, third in the foreign market, is garnering an increasing share of the tire and tube market abroad, and expanding in this field with retention of profits from current operations. The company's Brazilian plant, now under construction near Rio de Janeiro, will go into production in January. A plant at Amsterdam, Holland—the company's sixth in Europe—will be completed the middle of next year to meet the rising demand in the Benelux countries.

Natural Rubber's Predicament . . . . .

Warren S. Lockwood

THE two outstanding rubber factors of 1953 were the passage of synthetic plant disposal legislation and the devastating 10c drop in the price of natural rubber. The natural rubber growers join Congressman Shafer, the rubber manufacturers, reclaimers and traders in hoping the synthetic plants will be in private hands by the April, 1955, date called for in the legislation. At that point—for the first time since synthetic was introduced on a volume scale—natural and synthetic will be competing on the basis of price and quality alone. Natural rubber looks forward to such competition. The industry again completely agrees with American manufacturers and other experts that in the next decade's expanding rubber economy, synthetic and natural both will find an ample market.

The rubber dilemma, though, is what happens during the 16 months interim before the synthetic plants are sold. In that period natural rubber cannot be expected to stand on its own feet and take whatever the market offers—because natural is not competing with a free synthetic. The competition is with a synthetic controlled in production and price by the United States. It is, therefore, to the United States that the producers must turn for help when they are in trouble. And today, they are in trouble.

1953's drop in the price of natural rubber from 30c in January to approximately 20c now, confronts the natural rubber industry with the worst economic crisis since the depression. Actually, the fall is worse than the apparent 33⅓% drop. Based on 1952's yearly average rubber price of 40c, 1953's average of 24c, hit the rubber producers this past year with a 16c per pound drop in income. Projecting this in terms of world-wide tonnage, rubber income for Southeast Asian producers fell the equivalent of $575,000,000; for Malaya alone, the equivalent of $200,000,000.

This provides an economic dilemma not only for Malaya and the rest of Southeast Asia, but for the United States. The multimillion dollar drop in income has resulted in successive wage cuts for Malayan and Indonesian rubber workers, and severe income loss to the smallholders who produce so much of both country's rubber output. Malaya's approximately quarter billion dollar drop also means less money for the active Malayan war against Communism—less funds for the rubber replanting program that is necessary if next decade's rubber requirements are to be met—less outlay for the social services essential in fighting Communist propaganda at people level—less dollars for the sterling area.

All of these areas are vital to Malaya and the other Southeast Asian nations producing natural rubber. In today's struggle without boundaries, they are vital to the United States as well.

That is why during the past few months government officials overseeing American rubber policy have acted on suggestions growing out of the May meeting of the International Rubber Study Group in Copenhagen, and the subsequent October London meeting of the Special Management Committee, to make changes that would give the natural rubber market a chance to adjust to a more logical level.

The government is to be congratulated in easing the synthetic over-production problem by setting October, November, and December production at 41,000 tons per month; in withdrawing the directive calling for a higher mandatory use of synthetic than that called for by present rubber legislation as a national security requirement; and in their latest steps toward adjusting the rotation program so as to provide a fairer market for the lower grades of natural.

If these steps had proven adequate—well and good. But they have not, and the natural rubber market has not adjusted to levels that will permit a healthy Southeast Asian economy. It is essential, therefore, that government officials here move firmly to bring about such adjustment. The most important move they could make would be to adjust the price of GR-S from its current government-fixed 23c, to one more closely approximating the commercial level almost all observers agree will obtain when the plants are sold to private industry. Once the plants are sold, rubber prices will find their own level in free competition—and none will be happier for this situation than the natural rubber grower.

For the next sixteen months, though—until the synthetic plants are sold and the natural rubber industry is on its free competitive own, Southeast Asian economic health is at the mercy of American action on synthetic rubber production and pricing. An economically healthy Southeast Asia is vital not only to world-wide American defense plans—but to America's own commodity needs of the future. We sincerely hope that American officials bear this in mind when they make the decisions that can make or break the natural rubber industry—and the millions of Asian allies dependent upon that industry for complete support.

ESTIMATES OF WORLD NEW RUBBER PRODUCTION AND CONSUMPTION—1953-54*

(in 1,000 tons)

	1953			1954		
	Natural	*Synthetic*	*Total*	*Natural*	*Synthetic*	*Total*
Production						
U.S.A.	...	840	840	...	660	660
Malaya	575	...	575	575	...	575
Indonesia ..	695	...	695	685	...	685
Rest World.	440	80	520	440	90	530
Total	1,710	920	2,630	1,700	750	2,450
Consumption						
U.S.A.	550	780	1,330	600	680	1,280
Rest World.	1,010	80	1,090	960	80	1,040
Total	1,560	860	2,420	1,560	760	2,320

* Natural Rubber Bureau.

Envisions Promising Year . . . . .

Thomas Robins, Jr.

THE non-tire segment of the rubber industry will operate in a highly competitive market in 1954 and companies can be expected to put forth increased selling effort. We should be able to do as much business this coming year as in 1953. The 800 companies making rubber products other than tires are expected to consume about 470,000 tons of rubber, or 35 per cent of the industry total. This is approximately the same as 1953 consumption. Major products in which this rubber will be used include conveyor belting, industrial hose, foam rubber, gaskets and packing for machinery, molded goods and rubber footwear.

The outlook is particularly promising for conveyor belting and foam rubber. The demand for conveyor belting is steadily rising because of industrial expansion and the increasing mechanization and modernization of mines, mills and factories. Foam rubber is gaining in popularity in the furniture and automobile industries because of the increasing consumer demand for this type of cushioning.

Present indications are that the crude rubber market in 1954 will be fairly stable. The price of natural rubber, which rose to unreasonable heights at the outbreak of the Korean war, has returned to a more normal level. The savings resulting from this decline are more than offset, however, by a rise in other operating costs, particularly labor, transportation and plant equipment. As long as over-all operating costs remain at the present high levels, rubber manufacturers are not likely to be able to reduce their selling prices.

NEWS OF THE MONTH

GOVERNMENT-OPERATED SYNTHETIC PLANTS SHOW PROFIT OF $59.9 MILLION IN FISCAL 1953

ACCORDING to a report filed with Congress on December 30, 1953, by the Reconstruction Finance Corporation, the government's synthetic rubber program showed a profit of $59,900,000 in the year ended June 30, 1953. This was nearly four times the $16,000,000 profit recorded in the previous fiscal year. The record profit figure in fiscal 1953 was equal to 15% of sales, which amounted to $387,700,000. The $16,000,000 profit of fiscal 1952 was made on sales of $415,900,000. RFC stated that the major portion of the increase in profit in fiscal 1953 from fiscal 1952 is attributable to the 30% lower average price of alcohol consumed and to a reduction of 66%, or 100,000 short tons, in the production of alcohol-butadiene. Most of the 666,221 long tons of GR-S produced by RFC plants in fiscal 1953 was made from petroleum-butadiene.

RFC stated that GR-S sales at 685,000 tons for fiscal 1953 held their own in open competition with natural rubber, although that year was the first full year in the decade since the industry was born that synthetic rubber usage was not required by government controls. Total production of GR-S and Butyl rubber from government plants at 741,242 tons, represented 54.3% of total domestic new rubber usage.

GR-S latex production hit an all-time peak at 45,088 tons, with "cold rubber" latex accounting for 30% of the total. The rise was pronounced in the output of the oil-solids type of latex used in making foam sponge.

Equipment used to produce "cold rubber" GR-S was installed in three additional plants during the year, bringing total "cold rubber" capacity to 600,000 tons, or 72% of total GR-S capacity. About 356,000 tons, or 56% of total GR-S production, was in the form of "cold rubber" in fiscal 1953.

Oil-Masterbatch Sales

Marked gains were also made in sales of oil-masterbatch GR-S. Six of the thirteen GR-S plants together can now produce 240,000 tons of this material. Fiscal 1953's output of 108,054 tons of oil-masterbatch GR-S was 285% higher than in the previous year.

Aside from writing off $31,400,000 as depreciation, RFC put $6,100,000 into research in fiscal 1953. RFC also spent $21,900,000 for plant improvements and another $25,500,000 for maintenance and repair of the twenty-eight facilities in the synthetic rubber program.

Trade sources state that private industry is showing considerable interest in the sale of the government-owned synthetic rubber plants. It has been reported that the Rubber Producing Facilities Disposal Commission has been visited by many representatives of industry inquiring as to the technicalities of disposal procedure.

The Commission is said to figure that only about 100 companies in this country are large enough to take over a government synthetic rubber plant. About a fourth of these have had some experience with synthetic rubber, as operators of the plants under contract with the government.

The companies which have talked with the Commission during the past few weeks include not only most of the present operators of the facilities, but also a number of other firms which have never participated in the program. These talks have been informal in nature, presumably as preparation for entering concrete bids.

The feeling persists in some quarters, however, that few companies actually have the desire to invest large sums of capital in the government plants. Many of the rubber companies, it is said, find it to their advantage to have the government continue as a supplier of synthetic rubber, and would hesitate to take over the plants.

The disposal law, it is said, laid down conditions too onerous to encourage active bidding. Many influential legislators would like to see the plants remain under government ownership and might veto any sales negotiated by the commission.

Meanwhile, RFC announced the resignation of Morton E. Yohalem as special deputy for the Rubber Producing Facilities Disposal Commission, effective December 31, 1953. Mr. Yohalem announced plans to enter private law practice in Washington, D. C. He joined RFC in June, 1952, to develop recommendations for legislation authorizing the disposal of the government-owned synthetic rubber plants. The "Yohalem Report" which went to Congress last March was the culmination of that effort. It recommended immediate enactment of legislation permitting the sale of the war-born enterprise, and the disposal law was enacted a few months later.

RFC Administrator Kenton R. Cravens, in accepting Mr. Yohalem's resignation, said: "I would like to express my appreciation for the services you have rendered the Federal Government and this corporation. The advice and assistance you have given me have been extremely valuable."

Rubber Shipments to Red Bloc?

Authoritative sources in London stated recently that the Western powers are preparing to relax restrictions on the export of strategic rubber to the Communist world. Rubber shipments to Russia are now limited to about 80,000 tons a year, which the West hopes will be earmarked for civilian use.

No one would say how much would be authorized under the relaxed restrictions, but the amounts were expected to be "sizable". To begin with, it was said, the increased shipments will be limited to low grades of rubber which Western experts believe will be of little use to the Soviet war machine.

Agreement on the relaxation is said to have been "virtually reached" by representatives of the Atlantic Pact and the nations that fought Communism in Korea. These representatives meet periodically in Paris to review Western efforts to deny strategic materials to the Communists.

The Paris group has already approved Britain's cancellation of a ban on exports of low-powered automobiles to the Communist world, and it appeared certain that it will approve liberalization of rubber controls.

The eased rubber curbs are proposed as a means of aiding Ceylon and Malaya, who have been hard hit by the quota on shipments laid down by the West. Ceylon already has contracted to deliver 50,000 tons of rubber a year to Red China, and shipments began last year.

Moreover, a recent report from Ceylon stated that the government of that country is offering Communist China first option on purchasing Ceylon's surplus sheet rub-

ber. This has been estimated at 15,000 tons a year. The question of price is reported to be still under negotiation.

The Indonesian Information Office in the United States, however, reported that its government has rejected applications by rubber companies for export licenses on proposed shipments to Communist China. The companies, it was said, sought licenses shortly after receipt of news that an Indonesian mission to Peiping had reached preliminary agreement on a China trade treaty.

The information office said that a statement received from the Indonesian Foreign Ministry emphasized that the Sino-Indonesian trade agreement "is subject to further study by both parties." It noted also that the mission had reached basic agreement on "normal trade relations" between the two countries, and that specific government ratification is necessary to make it operative.

There was no indication when such action might be taken. In the first ten months of 1953, Indonesian rubber exports have totaled 586,467,000 pounds, a decrease of 47,032,000 pounds from the corresponding period of 1952. Prices in 1953, however, were reported nearly one-third lower than in 1952.

Rubber Division Meeting Plans

February 26 has been set as the deadline for abstracts of papers to be presented at the April 14 to 16 meeting of the Division of Rubber Chemistry, American Chemical Society, at the Brown Hotel in Louisville, Ky. The first technical session will be held on April 14 at 2:00 P. M. with J. C. Walton presiding. The chairman of the Local Arrangements Committee is Dr. F. C. Wagner (DuPont). The 25 Year Club Luncheon will be held at noon on April 14. A. M. Neal of E. I. du Pont de Nemours, Inc., P. O. Box 406, Wilmington, Del., is secretary of the division.

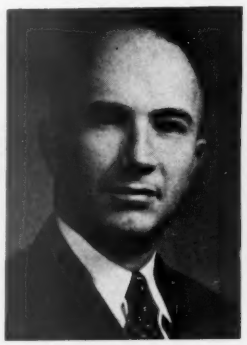
General Cable Signs Contract

Negotiators for the General Cable Corp. and the independent United Electrical Workers Union have agreed on a one-year contract calling for a 7-cent-an-hour general wage increase. Spokesmen for both sides said the new contract included increased welfare and seniority benefits. The pact covered production and maintenance employees at General Cable plants at Rome, N. Y., and at Los Angeles and Emeryville, Calif. About 1,600 workers, 1,000 of them in Rome, were affected by the agreement. The present wage scale ranges from $1.43 to $2.17.

"Research and Control Instruments—X-Ray and Analytical Equipment" is the title of a new 64-page reference book which is available from the Research and Control Instruments Division of the North American Philips Co., Inc., Mount Vernon, N. Y.

A new, reversible hunting and fishing jacket is being made of Krene by the U. S. Fiber and Plastics Corp., New York, N. Y.

GOODYEAR ANNOUNCES NEW APPOINTMENTS ON THE MANAGEMENT LEVEL



Sam DuPree

H. R. Thies

F. R. Evans

Key appointments on the management level at the Goodyear Tire & Rubber Co. were recently announced. Sam DuPree has been named general manager of all industrial products, while Herman R. Thies has been made general manager of all chemical products. Both are newly-created positions. At the same time, the company announced the promotion of Frank R. Evans as general manager of the Shoe Products Division succeeding Harry L. Post, who has retired. Mr. DuPree, with Goodyear since January 1, 1934, for the past year has been assistant to the vice-president in charge of sales as liaison executive with four divisions of the company—Industrial Products, Shoe Products, Chemical and Metal Products. In his new position, Mr. DuPree will coordinate and supervise all phases of Goodyear Industrial Products. Mr. Thies will assume full charge of the Chemical Division in all of its phases. He has been manager of the Chemical Division since it was organized in 1948. Mr. Thies joined Goodyear in 1930 as a rubber research compounder and in 1936 was appointed assistant director of research. In 1942, he was advanced to manager of Pliolite sales and three years later, was named head of the Plastics and Coatings Department.

Mr. Evans had been manager of the Shoe Products Division since 1936. He joined Goodyear in 1926 as a dispatcher in production control. He became foreman in production control two years later and the following year was sent to the new Goodyear-Australia factory as division superintendent. Returning to Akron in 1932, he was foreman in production control until being transferred to Windsor in 1936 as division superintendent. In 1944, he was made manager of factory sales service and in 1946 was named production manager of the Shoe Products Division at Windsor. In 1952, Mr. Evans took the Advanced Management Course at Harvard University. Mr. Post had joined Goodyear in 1913. He was manager of the Shoe Products Division from 1917 to 1922, then left the company to become vice-president in charge of sales for the Seiberling Rubber Co. In 1932, he took the position of president for the American Tire Alliance, Inc., Returning to Goodyear in 1936, Mr. Post resumed his former position as manager of the Shoe Product Division of the company.

Synthetic in Defense Orders

Military orders took 10% of the total GR-S synthetic rubber consumed in the United States during 1951, 1952 and the first six months of 1953, according to figures released recently by the Chemicals and Rubber Division of the Business and Defense Services Administration. This information on synthetic rubber consumption has been held confidential in the past, but was declassified by the BDSA in order to assist in the settlement of cases for renegotiation of contracts pending before the Renegotiation Board involving defense orders for finished goods. The report showed that although consumption of GR-S increased during the period, the percentage of the consumption under defense orders declined, until it averaged 10% for the thirty months' period, or 165,350 long tons out of the total consumption of 1,645,797 long tons.

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Polyethylene Plant in Operation

Production of polyethylene, one of the three critical industrial materials still in short supply, is said to have been increased 45% with the achievement of full-scale operation at a new plant in Texas City, Texas, according to an announcement by George C. Miller, president of the Bakelite Co., a division of the Union Carbide and Carbon Corp. Mr. Miller stated that with its production capacity rated at more than 60,000,000 pounds per year, this new plant is the first to come into production of the three new plants announced by Bakelite in 1953. The Texas City plant and the two other plants now underway are being built and will be operated by the Carbide and Carbon Chemicals Co., another division of Union Carbide. By mid-1954, production capacity of Bakelite polyethylene will again be increased as the second plant, rated in excess of 60,000,000 pounds annually, begins operation at Seadrift, Texas. The third plant at Torrance, Calif., will have a similar capacity and is expected to be in production in 1955.

SLIGHTLY REDUCED CONSUMPTION FORESEEN BY RMA FOR THIS YEAR

At the end of each calendar year, the Rubber Manufacturers Association, Inc., offers a recapitulation of activities in the rubber industry during that year and forecasts what may be expected in the coming year. The RMA's annual report for 1953, including its estimates for production and consumption in 1954, follows:

The year ahead shapes up as one of the best in the history of the rubber manufacturing industry. In 1953, rubber consumption will hit a record-breaking 1,341,000 long tons. Industry statisticians estimate that 1954 consumption will be only slightly off this figure.

Replacement passenger tire sales in 1954 are expected to exceed the 47,500,000 sold in 1953. Production of belting and hose and many other mechanical rubber goods is expected to equal the record output of 1953 on the strength of expansion of productive facilities in other industry. The foam rubber market continues to grow.

These growth items, among upwards of 40,000 different types of rubber products produced annually, are counted on to substantially cushion the impact of moderate declines predicted in the automotive industry and other industry markets for rubber parts, with the result that production of rubber goods is expected to taper off no more than 5% over the next twelve months.

In its summary of the industry's activity, RMA calls attention to the fact that 1953 consumption of new rubber was by far the greatest in the history of the industry. The substantial rise in consumption and the tremendous increase in synthetic rubber consumption over the years is reflected in Table I.

The ratio of natural rubber to total new rubber consumption in the United states has risen from 36.0% in 1952 to 41.4% on the 1953 figures. By October of 1953 the rates had risen to 44.4%.

Tire and Tube Statistics

Tire and tube manufacturers, who make up the largest single rubber consuming segment of the industry, produced 100,500,000 units. Of this number, 82,000,000 were passenger car tires, 14,700,000 truck-bus tires, 3,800,000 farm equipment tires, airplane and industrial pneumatic tires. Table II indicates the comparison over the past four years.

As noted in Table II, the rise in demand for replacement tires is expected to offset in part the somewhat smaller demand of the automotive industry for original equipment tires which has been forecast for 1954 by automobile manufacturers. The automobile industry is also an important market for foam rubber cushioning materials. But here again there is a strong and growing demand for latex foam products, particularly in the furniture, bedding and carpet under-lay industries which is expected to offset any decline in the requirements of the automotive industry for this product.

Manufacturers of light mechanical rubber goods, molded and extruded parts, expect a moderate tapering off in demand for those products of perhaps as much as 5% below the record levels of 1953. Principal users of these goods are the automobile industry and manufacturers of such home equipment items as refrigerators, freezers, washing machines and driers, radios, television sets and many like items.

Production of heavy industrial rubber goods, including all types of industrial hose and power belting and conveyor belting is expected to remain at or near the 1953 level. Similarly, good forward buying leads manufacturers of elastic thread to expect production at about the 1953 level.

Trend of homemakers to the use of resilient flooring gave manufacturers of rubber tile and rubber roll flooring a new record to shoot at in 1953. Supported by the growing popularity of their "do it yourself" program and the development of superior cements, the steady growth in the use of rubber tile is expected to continue in 1954.

While mild winters in the Eastern portions of the United States have done little over the past few years to stimulate demand for protective rubber footwear, the generally good weather has offset that by broadening the market for rubber-soled canvas footwear, particularly in the newer and more colorful sports line.

Manufacturers of rubber drug sundries improved unit production across the board in 1953.

The coated fabrics segment of the rubber industry produced about 50,000,000 yards of finished goods in 1953 and expects to maintain about that volume in 1954. Chief users of these products are the automotive industry and the makers of protective clothing, hospital sheeting, shoes and novelty items.

Figures on factory employment in the rubber manufacturing industry are not yet available for the full year. But over the first eight months, factory employment averaged 218,600 clockcard workers. Average hourly earnings of employees in the tire and tube industry in that same period rose to a new high of $2.23 an hour. That figure does not reflect either a general wage increase or extensive fringe benefits which were granted late in the summer. These latter benefits included improved pensions, company-paid hospitalization and surgical-medical insurance for employees and their families.

Most significant single development nationally in 1953, from the industry's standpoint, was action by Congress to authorize the sale to private industry of government-owned synthetic rubber facilities. The President's Synthetic Rubber Facilities Disposal Commission began taking bids on these plants November 25, 1953. While the bid period does not end until next May 27, the Commission is unofficially reported to have received already more than 100 expressions of interest.

Negotiations, as provided under the law, will continue for a period of seven months from May 28. It will not be until after that, a review of the sales proposal by the Attorney General and a review by Congress of the Commission's detailed report on the proposed sales, that there will be final decision sometime in the spring of 1955. Ultimate approval by Congress will hinge on whether the sales proposals meet the security, free competition and fair value criteria laid down in the law.

TABLE II—COMPARISON OF U. S. CASING PRODUCTION

	1950	*1951*	*1952*	*1953*
Passenger	78,598,000	65,546,000	74,341,000	82,000,000
Truck-Bus	15,156,000	17,859,000	16,070,000	14,700,000
Farm & Other	4,866,000	5,129,000	4,336,000	3,800,000
Total	97,620,000	88,534,000	94,747,000	100,500,000

TABLE I—U. S. RUBBER CONSUMPTION IN LONG TONS

	1941	*1950*	*1951*	*1952*	*1953*
Natural	775,000	720,268	454,015	453,846	555,000
Synthetic	6,259	538,289	760,283	807,567	786,000
Total	781,259	1,258,557	1,214,298	1,261,413	1,341,000
Reclaimed	251,231	303,733	346,121	280,002	284,000

Predicts Sales at $835,000,000

Indications are that sales of U. S. Rubber Co. will be between $830,000,000 and $835,000,000 for 1953, and net earnings will probably be equivalent to about $5 per common share, H. E. Humphreys, Jr., president, declared recently at a special meeting of the company's stockholders in New York City. Sales for 1952 were $850,000,000 and earnings per common share amounted to $4.33. Stockholders approved a modification of the company's retirement and disability allowance plan which will raise minimum retirement benefits for employees with 25 years of service from $100 to $125 a month. The increase is in accord with the agreement reached by the rubber company and the United Rubber, Cork, Linoleum and Plastics Workers of America, C.I.O., on September 28, 1953.

Wire Insulating Machinery Formed

Wire Insulating Machinery, Inc., 260 Tolland Turnpike, Station A, Manchester, Conn., was recently incorporated. The company is headed by H. H. Duff, who has had twenty years experience in designing and building wire mill machinery, besides extensive experience in the manufacture of insulated wire. The concern is in production on a line of new equipment of advanced design. The line presently includes continuous take ups, pay off stands, curing troughs, capistans, and a continuous take up and capistan in one package unit.

ANNUAL MEETING OF ASME RUBBER-PLASTICS GROUP IS WELL ATTENDED

Well attended sessions marked the Annual Meeting of the Rubber and Plastics Division of the American Society of Mechanical Engineers which was held at the Hotel Statler in New York City on November 30 and December 1, 1953. The meeting, held in conjunction with the 1953 Annual Meeting of the parent society, featured four technical sessions, two on rubber and two on plastics, with the rubber sessions held on November 30th and the plastics sessions on December 1st.

The rubber sessions, attended by audiences of more than 100 members and guests, featured the presentation of six papers and the usual annual report on rubber developments of interest to the engineering profession, while the plastics sessions, which were also well attended, featured four technical papers and the annual report on plastics developments.

S. W. McCune, III (DuPont) acted as chairman at the first rubber session with James B. Johnson (Linear) as vice-chairman, and P. D. Brass (U.S. Rubber) was chairman of the second rubber session with H. W. Greenup (Pilgrim Latex Thread) as vice-chairman. For the plastics program, Dr. R. K. Witt (Johns Hopkins University) was chairman of the first session with A. C. Webber (DuPont) as vice-chairman, and C. H. Adams (Monsanto) and Norman A. Skow (Synthane) as chairman and vice-chairman, respectively, of the second session. Considerable discussion followed several of the rubber and plastics papers.

Presentation of Rubber Papers

The first of the rubber papers was entitled "Synthetic Rubber Protects the Navy's Propeller Shafts" and was presented by E. A. Bukzin of the Bureau of Ships, Navy Department, Washington, D. C. Mr. Bukzin described the efforts made by the Bureau of Ships to protect propeller shafts from failures due to corrosion. Referring to the underwater painting systems first utilized for anti-corrosion purposes he pointed out why such systems were unsatisfactory and then told how and why rubber coverings for exposed shafting sections were adopted as a dependable means of protection. The soundness of the decision to use vulcanized rubber shaft coatings was confirmed after sixteen years of use on the *USS Brooklyn* when it was determined that the rubber covering was still in excellent shape.

The speaker also described some of the rubber coatings which have been developed in recent years, such as the brush-on neoprene and the flame-sprayed polysulfides. He indicated that although these coatings are not quite as tough and may not adhere as well as vulcanized sheet types they offer superior protection when compared with the best known paint systems. Methods of applying these coatings were described.

The use of cord fabrics in passenger and truck tires were covered by C. A. Litzler, president of the C. A. Litzler Co., Inc., Cleveland, Ohio, in a paper on "The Latexing and Hot Stretching of Tire Cord Fabrics, with Special Emphasis on Nylon". Although the speaker covered the processing of both cotton cord fabric and rayon cord he placed special emphasis on nylon tire cord because of the present tendencies of American tire manufacturers to accept nylon cord fabric as being superior to cotton and rayon for many important tire cord requirements.

Mr. Litzler went into considerable detail on the numerous problems involved, including the dipping or saturating operation, the removal of excess dipping solutions, the actual hot stretching operation, constant tension requirements, proper slicing, and latexing costs. On the question of cost, he stated that studies indicate that the cost of latexing full width fabric runs approximately 5c per yard of nylon latexed and hot stretched. This cost, he emphasized, is not appreciably greater than the cost of latex and tension drying rayon. In closing, he predicted that the use of hot stretching equipment will be expanded in the future.

Supplementing Mr. Litzler's talk was one on "Modern Rubber Calendering Equipment" by N. J. Elder of the Adamson United Co., Akron, Ohio. In this paper, descriptions were given of the major improvements made in calendering equipment for rubber and plastics since the end of World War II, such as crown compensation equipment for the rolls, circulating hot water temperature control systems, peripherally drilled rolls, circulating oil lubrication systems, and "zero clearance" equipment for the main calender bearings.

Through the use of excellent slides, Mr. Elder showed a typical calender train for producing thin film and sheeting, a typical application of tandem 3-roll calenders for double-coating tire cord, and two methods of utilizing 4-roll rubber calenders for double-coating tire cord. The major advantages of the relatively new Zee-type calenders were outlined, while developments in the use of roll crossing equipment and separate pinion stands for driving calenders were described. Other units described by the speaker included precision screwdown equipment, automatic stock feeding devices, gaging equipment and roller bearings.

Additional Papers on Rubber

"The Dynamic Characteristics of Silicone Rubber" by G. W. Painter of the Lord Manufacturing Co., Erie, Penna., was the first paper presented at the second rubber session. This paper dealt with the viscoelastic properties of silicone rubber under various conditions of strain, frequency and temperature and comparisons with natural rubber were made in several instances. The study was undertaken in view of the fact that the unusual high and low temperature properties of silicone rubber have made it a desirable material for vibration isolators designed for service at temperature extremes.

Among the conclusions reached in this study was the fact that the excellent low temperature properties of silicone rubber provides the vibration isolator designer with a material which will allow the isolator to function properly at —100° F. Although the modulus of the material is affected considerably more by static strain than is natural rubber, provision for this characteristic can be made in the design. Mr. Painter also described a dynamic modulus testing machine having considerable flexibility and high efficiency of operation. (EDITOR'S NOTE: This paper will be published in full in an early issue of RUBBER AGE.)

Engineering applications of the various types of Thiokol products were covered in a paper on "Mechanical Properties of Polysulfide Polymers" by J. S. Jorczak of the Thiokol Chemical Corp., Trenton, N. J. The speaker first described the various types of polysulfide rubber currently available and stressed some of their particular advantages and mentioned a few of their limitations. Among the products discussed were the polysulfide water dispersions and the liquid polymers.

Mr. Jorczak devoted a good portion of his talk to showing typical examples of the application of the polysulfide polymers to engineering problems in problem-and-solution form. This included problems of filleting, caulking, repairing and patching, impregnation, and sealing, and covered such products as windows, decks, hose, gloves, packings, cables, aircraft structures and electronic components.

The different types and grades of cellular rubber and methods of specifying them were described in a paper on "The Versatility of Cellular Rubber in Engineering", prepared by G. R. Sprague, J. J. Corrigan, and A. F. Sereque of the Sponge Rubber Products Co., Shelton, Conn., which was delivered by Mr. Sereque. The paper also described the essential properties of cellular rubber and the effect of temperature and common solvents on these properties. Typical examples of products developed to make use of these properties were given.

The different types of cellular rubber covered by the speaker included sponge rubber, foam rubber, expanded rubber, and ebonite or hard cellular rubber. Specific advantages of each of these four types were outlined and their engineering properties were stressed. Brief mention was made of expanded polyvinyl chloride which is a relatively new material quite similar to expanded rubber but with some unusual properties.

The annual report on "Engineering Developments of Rubber" was prepared and delivered by Miss Betty Jo Clinebell, Librarian, Rubber Division Library, University of Akron, Akron, Ohio. This report, which is published in full elsewhere in this issue, covered developments in the period from July, 1952 to June, 1953 and was well done.

Papers at Plastics Sessions

The first of the plastics papers was on "The Viscoelasticity of Polymethyl Methacrylate: An Experimental and Analytical Study," prepared by J. K. Knowles and Albert G. H. Dietz of the Massachusetts Institute of Technology, Cambridge, Mass. Presented by Dr. Dietz, this paper described static tensile stress-strain data under many different experimental conditions on several types of methyl methacrylate and included an empirical equation to describe these results. It also included an analysis of room temperature viscoelastic

characteristics of methacrylate. A paper on "Reinforced Plastics Laminates for Aircraft Use" was presented by Dominick Rosato of the Wright Air Development Center, Dayton, Ohio.

"New Developments in Liquid Heating of Plastics Processing Machinery" was the title of a paper prepared by Paul L. Geiringer and Floyd Hasselriis of the American Hydrotherm Corp., Long Island City, N. Y. Presented by Mr. Geiringer, this paper covered the application of high temperature liquids to the special heating and cooling requirements of plastics processing equipment with particular attention to temperature control. The ability of liquid heat carriers to meet the increasingly stringent requirements of the plastics industry was emphasized and the shortcomings of some of the presently applied heat carriers were outlined.

According to the speaker, liquid heat carriers offer five major advantages to the plastics industry as follows: (1) Uniform temperatures over the entire heat-transfer surface; (2) Full-range heating and cooling over wide temperature ranges; (3) Accurate temperature control with quick response; (4) Separate control of a number of individual temperature zones with one compact heating and cooling unit; (5) Program temperature control of heating and cooling.

A new and unique method of generating steam and high temperature vapor as applied to calender rolls and molding presses for the plastics industry was detailed in a paper on "Speedylectric: The Electrode Boiler" by Bradley C. Higgins of the Livingstone Engineering Co., Worcester, Mass. The Speedylectric units can be used in both closed and open systems and in both laboratory and factory operations. The unit generates steam by utilizing the resistance of the boiler water to the passage of electricity between solid metal electrodes.

The annual report on "Engineering Developments in Plastics", which also covered the period from July, 1952 to June, 1953, was presented by Dr. Paul O. Powers of the Pennsylvania Industrial Chemical Corp., Clairton, Penna. Developments of particular interest to the mechanical engineer were highlighted.

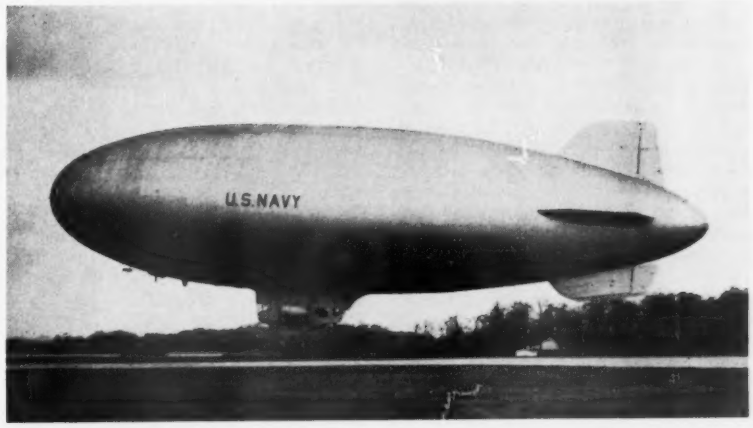
New Division Officers

At a meeting of the Executive Committee of the Rubber and Plastics Division, Allen Gifford, of the Lord Manufacturing Co., Erie, Penna., was elected chairman of the Division for 1954, and Gordon Thayer, of the Dow Chemical Co., Midland, Mich., was elected secretary. R. W. Barber, of the Panelyte Division, St. Regis Paper Co., Trenton, N. J., was elected a member of the Executive Committee for a five-year term. Other committee members include R. G. Seaman *(India Rubber World)* and Fred Wehmer (Rubber and Asbestos Corp.), M. E. Lerner (RUBBER AGE) is the retiring chairman and continues as a member of the Advisory Committee.

Appointments announced at the meeting included that of Norman A. Skow (Synthane) as Division Representative on the ASME Research Planning Committee, C. Howard Adams (Monsanto) as Chairman of the Plastics Papers Committee, M. E. Lerner as Chairman of the Rubber Papers Committee, and R. G. Seaman as Chairman of the Publicity Committee. D. H. Cornell (Goodrich) continues as Divisional Representative on the Professional Divisions Committee.

It was also announced that the Division will hold two sessions at the 1954 Spring Meeting to be held in Pittsburgh next June and four sessions at the Annual Meeting to be held in New York next December. Special symposiums are being planned for both meetings.

FIRST OF THE GOODYEAR ZP4K AIRSHIPS PRODUCED FOR THE U.S. NAVY



Shown above is the first of the ZP4K class of airships which are being produced for the U. S. Navy by the Goodyear Aircraft Corp. The ships are the most modern version of the intermediate "K"-type airship used so effectively in anti-submarine warfare service by the Navy in World War II. The ZP4K incorporates the Navy's latest developments adaptable to such aircraft for the purpose of locating and attacking enemy submarines in the event of war. Metal parts of the ship are manufactured at Goodyear Aircraft's Akron factories and the envelopes are made in the Arizona factory of the corporation at Litchfield Park. Gas capacity of the neoprene coated cotton envelope is 527,000 cubic feet of helium. A crew of eight men and officers will man each craft, the company announced.

Storm Footwear Sales Lag

According to recent reports, sales of rubber and storm footwear are lagging, due to another mild winter. Tyer Rubber Co., for example, is said to have laid off about 200 employees in its Rubber Footwear Division within the past few weeks. Hood Rubber Co. has also reported some shrinkage through layoff of non-permanent help. Converse Rubber Co. shut down its plant from the day before Christmas to January 4, 1954. The footwear plant of the U. S. Rubber Co. at Naugatuck has laid off approximately 300 employees. The plant also closed from December 23 to January 4, due primarily to the decline in demand. Bristol Manufacturing Co. cut its work force by about 200 and another big slash was scheduled in January when between 400 and 450 employees were to have been laid off. According to these New England rubber footwear manufacturers, plants in other parts of the country have also felt the impact of falling sales. While the mild weather is given as the main reason for the falling sales, foreign imports were also blamed for cutting into business at a time when sales are slow.

More Materials Show News

A group of 14 leading industrialists will serve as a board of sponsors for the second Basic Materials Exposition, the product development show, which will be held at the International Amphitheatre in Chicago, Ill., on May 17-20, it was announced by Clapp & Poliak, Inc., New York, N. Y., producers of the event. Don G. Mitchell, chairman of the board, Sylvania Electric Products, Inc., New York, N. Y., is chairman of the sponsoring board. The show, devoted to the materials used in the manufacture of products, will be more than double the size of the first exposition held in New York last June. More than 25,000 basic materials are currently available to manufacturers. Exhibits are planned to assist them in making their choices. Concurrently with the show, a three-day conference will take place in which project engineers, product designers, materials engineers, production experts, research men and sales and marketing executives will participate. Advance registration cards may be obtained by writing Clapp & Poliak, Inc., 341 Madison Ave., New York 17, N. Y.

Cornish Wire Expanding

Cornish Wire Co. with headquarters in New York, N. Y., has shifted a part of its wire making production to North Adams, Mass., to free plant space in its Williamstown, Mass., facility for other expansion. The new plant will be operated under the name of the Cornish-Blackinton Co. David Hawk, formerly associated with the B. F. Goodrich Chemical Co., has been named manager of the new plant. The company will specialize in the manufacture of electric wire and cable insulated with vinyl plastics.

RUBBER FOOTWEAR MANUFACTURERS CALL FOR RETENTION OF TARIFF

Rubber footwear manufacturers told Congress recently that tariffs must be preserved as the best means of compensating for differences in costs of production—particularly labor costs—between American-made goods and imports. Their statement was made in a brief filed with the Commission on Foreign Economic Policy which was distributed to members of both the House and Senate in a booklet setting forth the tariff views of the Rubber Footwear Division of the Rubber Manufacturers Association.

The group represents 14 of the 31 domestic companies engaged in the manufacture of waterproof rubber footwear and rubber-soled fabric footwear. The introduction to the booklet, entitled "Rubber Footwear, A Vital American Industry", is a reprint of a letter addressed to Mr. Clarence B. Randall, chairman of the Commission. Tracing the history of the rubber footwear industry, the document shows that it was American-founded and developed, beginning over a hundred years ago and now offering steady employment to more than 22,000 production workers. Average annual production is given at 75,000,000 pairs of both types of rubber footwear, representing over $200,000,000 in sales value at the manufacturers' level, the booklet says.

The rubber footwear manufacturers told the Randall Commission that tariffs are necessary if domestic manufacturers of rubber footwear are to compete fairly with imports. Their letter asserts that the quick acceptance given the slogan "Trade not Aid", has thrown tariffs out of true focus. It goes on:

"Many persons—including some in high places—appear to be convinced that existing international economic ills can be cured simply by opening the United States markets to imports. They endorse the theory that if the United States abolishes all tariffs every country—including the United States—will enjoy fabulous prosperity.

"Anyone who tries to place tariffs properly in the picture opens himself to bitter criticism as to his humanity, his intelligence and even his patriotism. If he is in business, he is accused of being too cowardly to face foreign competition or too inefficient to meet it.

"American manufacturers of rubber footwear cannot justly be criticized on any of these points, yet they strongly favor a tariff on imported goods that compete with their products. They favor free enterprise and free competition; but insist that before competition can be free it must be fair. They have no fear that foreign producers will outpoint them in efficiency or industry." The letter states further:

"It is folly to encourage the importation of any goods into this country if they merely replace the production of an American worker. It is foolhardy to pursue such a course with goods that are essential to the national security of the United States."

The rubber footwear manufacturers inform Congress that their products are "essential to the national welfare and the national security". They point out the footwear they make is health-building and health-protecting; that during World War II, when rubber was strictly rationed, the industry was allocated rubber to make both civilian and military footwear. The booklet reports that during the war more than 45,000,000 pairs of rubber footwear were made for the Armed Services, and that the industry was called upon to develop many new types of rubber footwear for combat use.

In relating the history of the industry, the booklet tells how the American manufacturers—for a long period the sole suppliers for the world markets—were driven out of the export field by competitors abroad who copied "American designs and methods". Department of Commerce figures are presented to show that in 1919 the American manufacturers had 58.87 percent of the world's export markets for rubber footwear, while Japan and Czechoslovakia (for over a quarter-century the two most important foreign producers) had none. By the early 1930's United States held less than 2 percent, Czechoslovakia held over 8 percent and Japan dominated the field with 63 percent, the booklet says.

The rubber footwear manufacturers make it clear in their presentation that their concern now is to hold the American market, which they insist they cannot do without compensatory tariffs on competing imported goods.

New Emery Research Center

Emery Industries, Inc., has started construction of a new $800,000 research center adjacent to its plant in Cincinnati, Ohio. The new building will provide new and larger quarters for the Departments of Basic Research, Development, and Chemical Engineering. Constructed of brick, the two-story L-shaped structure will contain 30,000 square feet, and will house 28 individual laboratories in one wing with several "application" laboratories in the basement. Equipment in the latter rooms is designed to evaluate on a "plant" scale all of Emery's fatty acids, plasticizers, and textile oils. The new building will allow expansion of Emery's research facilities to accommodate approximately 100 people. Additional wings can be added to house another 150. The other wing will contain the research executive offices, library and conference rooms.

NAWMD Plans New York Meeting

The Forty-first Annual Convention of the National Association of Waste Material Dealers, Inc., will be held March 15 through 17 at the Waldorf-Astoria in New York City. Other meetings scheduled for early 1954 include an area meeting of NAWMD's Midwestern Division at the Hotel Statler, Detroit, Mich., on February 1, and an area meeting of the Pacific Coast Division of NAWMD on March 1 at the Olympic Hotel, Seattle, Wash. The program for the national convention as well as the plans for the area meetings will be issued in the near future.

Acquires Titeflex Filter

Titeflex, Inc., of 500 Frelinghuysen Avenue, Newark, N. J., has announced the sale of the design and manufacturing rights of the Titeflex industrial filter for the chemical and processing markets to Croll-Reynolds Engineering Co., Inc., of 17 John St., New York 38, N. Y. Titeflex is a leading manufacturer of flexible metal hose, and a leading producer of a wide range of aviation components which includes: electrical connectors, ignition harnesses, wiring systems, flexible and rigid wave guides and precision bellows. The Croll-Reynolds Engineering Co. manufactures packless bellows type expansion joints under the trade name, Flexo Disc, for oil refinery, industrial plant and marine pipe lines. It also manufactures shell and tube heat-transfer apparatus for the chemical and other process industries. John J. Quinlan, sales manager of Croll-Reynolds, stated that the Titeflex filter was purchased to provide a more complete service to the chemical and process industries. To provide uninterrupted sales and service of the Titeflex filter, Croll-Reynolds have acquired the inventory and manufacturing facilities used in the production of this equipment.

Burgess Chemical Changes Name

The directors of the Burgess Chemical Co. of Paterson, N. J., have announced a change in the company's corporate name to Cary Chemicals, Inc. Kenneth B. Cary has been elected president of the company, while George F. Blasius has been named executive vice-president and general manager. Warren D. Sechrist has been elected vice-president and plant manager, and Earl M. Turner has been named vice-president. Garret Roosma, Jr., has been elected secretary-treasurer. Messrs. Cary and Blasius have resigned as officers of the Burgess Pigment Co. and will devote their full time to the marketing and promotion of products manufactured or handled by Cary Chemicals. The laboratory and plant of Cary Chemicals are located at Milltown, N. J., with executive offices at 64 Hamilton St., Paterson, N. J. Cary Chemicals manufactures vinyl compounds, reclaiming oils, sun-proofing waxes, gilsonite compounds, pitch compounds, tall oil esters, stearine pitches, and other related materials. It also markets, as sales agents, other essential compounding ingredients for the rubber and plastics industries.

RCA Opens New Boston Office

Rubber Corporation of America, 274 Ten Eyck Street, Brooklyn 6, New York, has announced the opening of a sales office at the Little Building, Room 821, 80 Boylston Street, Boston 16, Mass. Cornelius T. Lyons, who has been sales representative in the New England states for the Rubber Corporation's line of plasticizers, plastisols and latex compounds, will be in charge of this office. All sales of natural and synthetic rubber latex to New England customers will be handled through this office, in addition to plasticizers, plastisols and latex compounds.

Joins U. S. Rubber Reclaiming

Dr. Henry F. Palmer

Dr. Henry F. Palmer has been named vice-president in charge of research and marketing of the U. S. Rubber Reclaiming Company, Buffalo, N. Y., according to a recent announcement. Dr. Palmer comes to his new post with 28 years of administrative and technological experience in the rubber industry. He has been particularly active in phases of the industry related to reclaimed and synthetic rubber. Since 1950, Dr. Palmer has served as general manager and vice-president of the Kentucky Synthetic Rubber Corp. of Louisville, Ky. This was the organization set up by eleven companies to operate Plancor 1278, a government-owned GR-S synthetic rubber plant. Before that, he was for four years a private consultant in rubber technology.

Earlier, Dr. Palmer spent 21 years with the Firestone Tire & Rubber Co. of Akron, Ohio. Starting as a research chemist, he later became the company's assistant chief chemist. Subsequently, as chief chemist for the Xylos Rubber Co., a Firestone subsidiary, he developed a new high-pressure method for reclaiming rubber. Known as the Palmer process, it performed in a few minutes what formerly had taken from 12 to 24 hours. Later, on loan from the Firestone company for two years, Dr. Palmer served as production manager for the government's synthetic rubber plants.

Calls for Improved Roads

P. W. Litchfield, chairman of the board of the Goodyear Tire & Rubber Co., in his "Notes on America's Rubber Industry: No. 20"—"A Missing Key to Our Highway Problem", points out that this country's highway problem must be attacked through aggressive organization at the city, county and state levels if it is to be cleaned up. Mr. Litchfield urged that efforts be concentrated on getting roads built and bridges widened in our own neighborhoods, in our own cities and states. Unless this sentiment is so organized and directed, he said, it cannot exert full force at those points where enabling legislation is enacted and contracts for actual construction are awarded.

Need a personal file of RUBBER AGE? Use the coupon on page 631.

Curved Hose Output Modernized

Mechanized, straight-line production for the manufacture of curved radiator hose is now in operation at the new B. F. Goodrich Co. plant in Marion, Ohio. The capacity of the new manufacturing department is designed to take care of the requirements for the foreseeable future. It represents an investment in excess of a quarter million dollars. Advanced mechanization improves quality by reducing handling of the product in its various stages of production. Short lengths of uncured radiator hose are placed on mandrels which give them a curved shape. The curved mandrels are mounted on flat plates, hooked together in trains and automatically pulled into the vulcanizers on a roller conveyor system. Following vulcanization, plates are delivered on the conveyor system to a central point where the hose is stripped off the mandrels and deposited on a conveyor which transfers it to the following operation. The conveyor continues then to the loading area.

Multi-decked conveyor-roll racks, equipped with automatic loading and unloading elevators, are provided at all necessary points for better use of floor space and elimination of manual operations. The product is gravity-fed from the racks to the next manufacturing process, as needed. The new $2,500,000 Marion plant, devoted chiefly to the manufacture of high pressure hose, is equipped throughout with the most advanced hose manufacturing machinery in the country, the company stated. Mechanized, straight-line flow systems eliminate many hand operations and insure uniform product quality.

Sheahan Retires at Goodyear

D. E. "Ed" Sheahan, veteran of thirty years with the Goodyear Tire & Rubber Co., and former superintendent of the company's Plant 1 in Akron, Ohio, retired on January 1. He had been superintendent of Plant 1 from July, 1947 to last September. From that time to January 1, he served in an advisory capacity to general superintendent Leroy Tomkinson. Scores of his friends honored him on December 30 at an informal party in the Plant 1 cafeteria. Born on January 11, 1888, Mr. Sheahan started with the company as an inspector in the Calender Division. He progressed through various positions at the company and in 1941 became superintendent of the Tire Division at Plant 2 in Akron. He held this post until taking over the superintendent's post at Plant 1.

Lehigh Study on Engineers

Lehigh University of Bethlehem, Penna., has made available a new booklet entitled, "More Engineers", which has been designed to interest industrial firms in the establishment of scholarships at Lehigh University. The booklet stresses the point that there is a continuing shortage of engineers, and that this situation is likely to become worse. The booklet outlines the manner in which these shortages can be alleviated, and advances the plan which the university has developed to meet this end.

Sparrow Promoted by Marco

Robert F. Sparrow

Marco Co., Inc., Wilmington, Del., has announced the appointment of Robert F. Sparrow as sales manager. Marco manufactures the "Flow-Master" line of continuous processing equipment for the chemical, food and rubber industries. Mr. Sparrow joined the Marco Co. as service manager in 1945 after serving 5 years in the Navy. In 1947 he was advanced to the Research Division and still spends part time in research and development activities. He holds a degree in economics from Tufts College.

Introduces Improved Type Yarn

American Enka Corp., New York, N. Y., has announced that the entire output of the company's high tenacity yarn is now being produced in a new improved type which is being sold at the same price as the former yarn. This improvement is the result of several years of research and development at both company plants in Enka, N. C., and Lowland, Tenn. Consumers of American Enka high tenacity yarn have effectively collaborated in the furtherance of this product improvement program. The new yarn embodies a number of processing changes and refinements designed primarily to bring about increased strength and flexing endurance, important to improved tire manufacture. Enka's own experiments indicating a strength improvement of approximately 10% in various cord constructions have been confirmed by the tests of Enka yarn users. The change-over to the new yarn was accomplished at both plants late in October and since early December all shipments to Enka's tire industry and other high tenacity customers have been in this improved type.

Rayon Group Moves Offices

The American Rayon Institute, formerly the Rayon Information Center, has opened new offices in the Empire State Building in New York City. The institute expects to move into permanent headquarters by the first of May. In the meantime, the temporary space in the Empire State Building will provide offices for the staff. Plans for the permanent quarters include a conference room and a display room in addition to offices.

OVERLEY REPORTS ON EXPANSION GOALS IN THE RUBBER INDUSTRY

On November 19, before a combined meeting of the Chemical Market Research Association and the Chemical Marketing and Economics Division of the American Chemical Society at the Shoreham Hotel in Washington, D. C., S. Earle Overley, chief of the Rubber Branch, Chemical and Rubber Division, Business and Defense Services Administration, Department of Commerce, delivered a report on the "Expansion of the Rubber and Rubber Products Industry as Related to the Government Industrial Expansion Program".

Mr. Overley explained that rubber and rubber products were programmed under three expansion goals covering horizontal wire braided hose, tires of specified sizes and types, and rubber and rubber products. There were 180 applications certified for a total of $116,000,000 worth of facilities and $53,700,000 certified for accelerated tax amortization, or 46% of the value of the facilities.

The above goals were not established until early in 1952. Prior to that time an informal program for an expanded capacity of reclaimed rubber was set up and some applications were processed. A preliminary target had been formulated for horizontal wire braided hose so additional production could be expedited. Aside from these, applications were processed on a group or individual basis, most of which were predicated on defense contracts.

Prior to the freeze in August, 1951, after which the major portion of the applications were processed under goals, the Division had initiated surveys for capacities, also defense and essential requirements for tires and horizontal wire braided hose. On many other products spot checks were made in order to gauge operations, Mr. Overley declared.

Tire Production Facilities

The analysis of tire production facilities as of January 1, 1950, and the defense and essential civilian needs for a program based midway between accelerated and full mobilization, indicated a capacity shortage in certain size groups only. These size groups fell in the vulcanizing press size of 55 inches or equivalent and up. The capacity in these groups total 37,500 units per day, while the total demand would be 60,000 units; therefore, an expansion of 22,500 airplane, truck and bus and tractor-implement tire casings per day were requested and approved. Practically all of this amount was certified during the first quarter of 1952.

The total dollar value of the facilities certified was $75,000,000. The portion authorized for accelerated tax amortization was $28,000,000, or approximately 37% of the amount certified for facilities. No new plants were authorized. The distribution as far as possible was on the historic pattern of the industry. There were 67 net certificates for facilities in 25 cities in 14 states. The expansion in Akron was only between 7% and 8%, whereas the general pattern is approximately 30%. The present capacity of the size groups involved is 52,000 units per day, and by 1955 the full program of 60,000 is expected, Mr. Overley declared.

A forecast for 1955 is difficult as the military take is not known, he said, but it may be assumed that short of an all out major war there will be an excess of facilities for civilian and military providing all old facilities are maintained.

The capacity survey and estimated military and essential civilian demand for horizontal wire braided hose indicated that the 25,000,000 feet per year capacity as of January 1, 1950 would be short 45,000,000 feet to satisfy the accelerated program. At the time this program was requested there were production problems which made it expedient to be liberal as to the amount of facilities certified. Military specifications were extremely severe. In order to get wider distribution several companies which had not been producing in this specific field were considered; therefore, full production with military approval of the product could not be expected for a period of time.

There were 18 certificates issued, one of which has lapsed, for $8,400,000; of this $5,100,000 were certified for accelerated tax amortization, or approximately 61% of the total dollars. Forty percent of the expansion is in new locations. At present, the capacity approximates 62,000,000 feet per year. No further expansion is anticipated until new military requirements are made available and enough time has elapsed for producers to have ironed the bugs out of their production methods and to meet military specification requirements. Unless we are faced with a major military conflict, or a major change in military specifications, the present facilities should be sufficient to supply the demand for 1955. Military need for this product is high compared to civilian.

After the issuance of expansion goals for tire casings and horizontal wire braided hose, it was decided to cover the balance of the rubber products and materials by a miscellaneous goal as many applications had been processed for products which might have been separately programmed. The goal was set at $80,000,000. It was different from other goals as the dollars were a ceiling only with no attempt to certify such an amount. For convenience, this goal was subdivided into eleven groups.

The important groups for which certificates were issued were special purpose synthetic rubbers, reclaimed rubber, rubber parts for tank track assemblies, microporous separators for batteries, fuel cells and precision seals, gaskets and rings, Mr. Overley stated.

Reclaimed rubber was set up as a project early in 1951. The pre-Korea annual capacity was about 385,000 long tons on an all out basis. The expansion certified was 87,000 tons. The present capacity approximates 465,000 tons and the ultimate capacity by the middle of 1954 should be 475,000 tons. This amount is far more than ample for peacetime operation, but might be fully utilized in case of an all out war. This would depend upon the supply of other rubber, the adequacy of the natural rubber stockpile and other factors of like nature.

Most of the applications in the other groups in this goal were processed on a basis of military contracts and technical know how, providing there were no open facilities with companies which could readily qualify. There were 95 applications certified for $32,500,000 worth of facilities and $20,600,000 authorized for accelerated tax amortization. Practically all of these facilities are in production and should satisfy the defense and essential civilian needs. Additional expansion would no doubt be needed in certain groups on a very selective basis if an all-out emergency should exist, Mr. Overley concluded.

Leonard Weirich, chief of the Organic Chemicals and Drug Branch of the Chemical and Rubber Division, and T. Allen Davis, commodity industry analyst with the branch, also presented a report at the meeting. The report was entitled, "Expansion of the Industrial Organic Chemicals and Drug Industry as Related to the Government Industrial Expansion Program."

Some 38 organic chemicals came under the expansion program. For the purposes of this appraisal, the total capacity, in pounds, was calculated for all 38 organics at three empirical but significant stages and each compared to the corresponding total capacity which existed January 1, 1951, commonly regarded as pre-Korea. The three stages selected for comparisons were: (1) That capacity in place as of June 15, 1953; (2) That capacity required by the total goals; (3) The anticipated total capacity including that unassisted by certificates of necessity.

Selected Chemical Spot Check

In a spot check of selected organics, it was shown that the pre-Korea capacity of benzene, for example, was 215,000,000 gallons. By June of 1953, it was 325,000,000 gallons and by 1955 it is anticipated that it will be 375,000,000. Ethanol capacity was 398,000,000 gallons, pre-Korea, and by 1955 it is expected to be 501,000,000 gallons. Capacity stands at 441,000,000.

There appear to be certain rather salient facts regarding the progress of the expansion in the organic chemical industries during the period since the beginning of the Korean affair. (1) There has been an increase in capacity since January 1, 1951 of approximately one-fourth as of June 15, 1953, or 125%. (2) The anticipated increase in organic capacity by the completion of the goal period is estimated to be one-half the pre-Korean capacity or 150%. (3) The increases scheduled by the establishment of the goals represent 86% of the total anticipated increase in capacity.

Also, (4) Approximately 80% of the anticipated (goal and unassisted) expansion through the goal period (January 1, 1951 to January 1, 1955) is supported by accelerated depreciation certificates. (5) The industry will be slightly over-expanded as based upon the goals established provided all scheduled increases are completed including that both assisted and unassisted. (6) The anticipated expansion for the goal period corresponds to a 13% per year increase.

SEIBERLING RUBBER ANNOUNCES FORMATION OF PLASTICS UNIT

Seiberling Rubber Co., Akron, Ohio, has announced that it has organized a new Plastics Division, and that it is already in production on a pilot plant basis. J. P. Seiberling, president, said the Plastics Division is the first major product diversification entered into by the company since World War II, and that work on the project is proceeding rapidly.

Initially, Seiberling will concentrate on the fabrication of rigid plastic material with special properties of tensile strength, chemical resistance, or other desirable characteristics, the company president said. This material, produced in sheet form, then will be resold to manufacturers for conversion into special products, he added. The company also will fabricate some finished products not in competition with its customers, Mr. Seiberling said.

New and previously untried methods of processing the rigid plastics have been developed by the firm's New Products Department, which has worked on the project for over two years, Mr. Seiberling said. We will not become a manufacturer of chemicals," he said. "We will buy raw materials from chemical companies which specialize in them, and which constantly are making new discoveries and improvements in these substances. Our people have found new ways of processing the materials. We believe the resulting products are superior to anything produced to date. Both our suppliers and our customers tell us this is so."

Seiberling, which sells its tire lines on a "premium" basis, will concentrate on quality rather than on volume manufacture in the Plastics Division, the company president said. "This quality is the result of methods and combinations of materials which are our exclusive development."

The Seiberling Plastics Division will occupy a new plant at Newcomerstown, Ohio, about 60 miles south of Akron, which is expected to be in operation about midsummer of next year. However, the company already is producing plastics in limited quantities, Seiberling said.

"In order to develop our processes on a production basis, it was necessary to purchase some plastics equipment and machinery, and to begin pilot plant operations at our Akron plant. We actually have been selling the material in various forms for over a year," he said, "and the demand is very heavy. We are entering a new business, but our market is ready-made." Mr. Seiberling did not reveal the size of the project, but said that the Plastics Division will have facilities "adequate for present needs," and can expand as demand increases and new product lines are added. The Newcomerstown Chamber of Commerce will donate the plant site, and the company is arranging to lease the buildings through a trust.

The company's main line is non-plasticized polyvinyl chloride, processed into sheets of different thicknesses and grades, having special properties—including resistance to chemical action, high tensile strength, or adaptability for decorative purposes. Other lines developed by Seiberling include a substitute leather which the company says is superior in appearance and durability to any competitive substance, for use in luggage, belts, and other apparel items.

Vinyl Standard Available

The printed edition of "General Purpose Vinyl Plastic Film, Commercial Standard CS192-53," is now available for sale by the Superintendent of Documents, according to an announcement by the Commodity Standards Division of the U. S. Department of Commerce. The standard became effective for new production on May 22, 1953, and is referenced in the Flammability Fabrics Act, Public Law No. 88 of the 83rd Congress, effective June 30, 1954. The specification covers methods of test and requirements of general purpose plain or embossed vinyl plastic film to insure satisfactory products for consumer use. The requirements and methods of test specify thickness tolerances, yield per roll, width tolerances, shrinkage at elevated temperatures, contamination, appearance, cracking, tensile properties, tear resistance, volatility of plasticizer, water extraction, low temperature impact and flammability. Suggested forms for declaring compliance with the standard, and an identifying hallmark are included. The standard was established at the request of the Society of the Plastics Industry. Copies may be purchased from the Superintendent of Documents, Government Printing Office, Washington 25, D. C., for ten cents each.

Dauler Elected Neville President

Neville Chemical Co. of Pittsburgh, Penna., has announced the election of Lee V. Dauler as president and D. W. Kelso as vice-president. Mr. Dauler was formerly vice-president, while Mr. Kelso retains his former post of treasurer. Edwin Hodges, Jr., formerly chairman of the board and president, continues as chairman, and John C. Bane, Jr., continues as secretary and assistant treasurer. W. F. Eberle and R. E. Dingleberg were elected as assistant secretary and assistant treasurer, respectively.

RUBBER AND PLASTICS SCRAP MAKE POOR SHOWING IN 1953

According to a recent statement by Milton Kushkin (A. Schulman), president of the Scrap Rubber and Plastics Institute of the National Association of Waste Material Dealers, Inc., the year 1953 has been a very poor one from the standpoint of the dealer in scrap rubber.

Prices have moved within a very narrow limit with tires bringing $13.50 per net ton from the reclaimers throughout most of the year. This is the same price level in effect in 1950 prior to the Korean outbreak. Freight rates and other handling costs have advanced considerably since 1950, so the result is that the net price for a dealer handling rubber has been reduced.

Production of reclaim rubber for the year continued at a fairly good rate, and the reclaimers have been able to get all the scrap they needed at the low levels, he said.

The demand for split parts has been very limited. Producers in areas not close to reclaiming centers have been burning and destroying their S.A.G. The peels have been bringing enough to justify saving them, but most of the year there have been more peels produced than were consumed, consequently prices have been low.

Red tubes seem to be over the hill and on their way to oblivion. The price for red tubes has been very good, but the last of the year finds very few reclaimers interested in buying at any price, evidently because they know they are at the bottom of the red tube barrel, Mr. Kushkin declared.

Black tubes have had a fairly steady market, but the supply is greatly reduced because not too many are being made anymore. They seem destined to eventually follow red tubes down the road to oblivion. Butyl tubes have been available in much larger quantities than the reclaimers would consume, so the price has drifted down to about the 2c level. They will remain there until more demand is created by the very fact that here is a large volume item at a low price.

The crude rubber market drifted from over the 30c level about the first of the year to below the 20c level early in the fall and at this writing is about 22c and still rising, Mr. Kushkin stated. Synthetic rubbers have had a steady price since they are government controlled. The last half of the years finds production reduced and the lower crude rubber prices have had the effect of reducing consumption somewhat.

Plastic prices were steady to strong throughout the first three-quarters of the year, but in the last quarter prices were soft with some grades at prices about one-half of what they were earlier in the year. In spite of the poor showing that scrap rubber has made during 1953, 1954 will be a better year, Mr. Kushkin observed. "I think 1954 should be a good year for business in general and scrap rubber, having already been down to the bottom, will start turning and move uphill toward more consumption and higher prices," he concluded.

RUBBER GROUPS ABOUT THE COUNTRY HOLD ANNUAL CHRISTMAS MEETINGS

The various rubber groups about the country brought 1953 to a close with the traditional Christmas meeting. Group members and their guests generally enjoyed a special dinner, programs of entertainment and, in some cases, elected officers for the new year. The following groups have reported on their activities during the holiday season:

BOSTON RUBBER GROUP

Approximately 600 members and guests attended the Christmas Party held by the Boston Rubber Group on December 11 at the Somerset Hotel in Boston, Mass. The following members were elected to office for the new season of the group: *Chairman,* W. Fraser Malcolm (Titanium Pigment); *Vice-Chairman,* Edwin D. Covell (Stedfast Rubber); *Secretary-Treasurer,* James E. Williamson (Tyer Rubber). David W. Kirkpatrick (Boston Woven Hose) was elected chairman of the Executive Committee. R. B. Huber was chairman of the Nominating Committee. Members and guests enjoyed a cocktail hour, a dinner, a program of entertainment and a drawing for door prizes.

BUFFALO RUBBER GROUP

The Buffalo Group held its annual Christmas Party on December 15 at which time announcement was made of the new officers for 1954. Members elected to office include: *Chairman,* Glenn Meyers (James O. Meyers); *Vice-Chairman,* Charles Johnson (Hewitt-Robins); *Secretary-Treasurer,* Paul Schwet (Hewitt-Robins). Don Gubala (Pierce & Stevens) and Ford Jenkins (O'Celo) were elected to the Executive Committee for a three-year term, while Don Schuler (Dunlop Tire) and Frank Niemczyk (Buffalo Weaving) were elected to the committee for a two-year term. Neil Peffer (Buffalo Weaving) and Ed Martin (Hewitt-Robins) were elected for a one-year term.

CHICAGO RUBBER GROUP

The Chicago Rubber Group held its annual Christmas Party on December 18 at the Morrison Hotel in Chicago, Ill., with almost 800 members and guests present. The party featured entertainment and dancing and the distribution of mink collars as gifts to the ladies present. B. J. Yunker (Chicago Rawhide) was chairman of the Party Committee with Frank Smith (Williams-Bowman) as vice-chairman. Morris O'Connor (O'Connor & Choate) and Howard Anderson, Jr. (Park Rubber) handled the ticket and seating arrangements. James Dunne (C. P. Hall) and H. C. Crosland (Chicago Rawhide) were in charge of gifts. John Swart (Van Cleef) and Ralph Schell (Bauer & Black) took charge of contributions. The Entertainment Committee consisted of Eli Grossman (Tumpeer Chemical) and William Urbanek (Dryden Rubber).

LOS ANGELES GROUP

The Los Angeles Rubber Group held its annual Christmas Party on December 4th at the Cocoanut Grove of the Ambassador Hotel in Los Angeles, Calif., with 670 members and guests in attendance. The Cocoanut Grove was taken over by the group for the occasion which consisted of an informal dinner dance. Entertainment featured the music of Jerry Gray and his orchestra, the songs of Lena Horne, and the Belmont Dancers.

NEW YORK GROUP

The Henry Hudson Hotel was the site of the 1953 Christmas Party, held by the New York Rubber Group on December 11 in New York City. Approximately 500 members and guests attended the affair which featured a cocktail hour, the serving of a dinner, a program of entertainment and a drawing for door prizes.

SOUTHERN OHIO GROUP

The Southern Ohio Group held its annual Christmas Party on December 12 at the Miami Valley Golf Club in Dayton, Ohio, with some 225 members and guests in attendance. The meeting featured an announcement of election results for officers for the new season. Members elected to office include: *Chairman,* Frank Newton (Dayton Rubber); *Treasurer,* Carl A. Griep; *Secretary,* R. Hoskin (Inland Mfg.). The following members were elected as directors: Herman E. Wening, Robert S. Radow and Roy A. Marston. The program began at 7:00 P. M. with the serving of a dinner. This was followed by the distribution of door prizes and then a program of dancing and entertainment. This year, the Southern Ohio Group Christmas Party was supported by manufacturers in the area rather than by the suppliers.

Orders Dismissal of Charges

A hearing examiner of the Federal Trade Commission ordered, on December 23, that charges of price discrimination against the B. F. Goodrich Co. be dismissed. The examiner, in an initial decision, ordered dismissal of a complaint charging the company with discriminating on footwear prices between different purchasers. The complaint alleged that the discrimination stemmed from a quantity discount schedule setting up ten brackets for discounts of from 3 to 18%. The examiner, whose decision is not the final commission ruling, found that the price differences were "cost justified". The Clayton Anti-Trust Act provides that price differentials are not unlawful if they "make only due allowance for differences in cost of manufacture, sale or delivery." Under commission rules, the counsel in support of the complaint has thirty days to appeal the examiner's ruling. The commission may also docket the decision for review or stay its effective date.

A new 40-page catalog illustrating and describing a complete line of shoe products for the manufacture and repair of shoes has been released by the Shoe Products Division of Goodrich.

DUPONT ANTI-TRUST CASE GOES TO JUDGE FOR VERDICT

Except for the filing of four documents, the long civil anti-trust suit against E. I. du Pont de Nemours & Co., Inc., General Motors Corp., U. S. Rubber Co., and 33 individual members of the du Pont family was in the hands of U. S. District Judge Walter J. LaBuy as the government and the defense rested their cases on December 21, after 102 days of court sessions. The trial began on November 18, 1952, and since that time more than 2,250,000 words of testimony have been recorded in a printed transcript which covers 8,300 pages.

The government suit charges DuPont and 33 family members conspired to gain control of General Motors and U. S. Rubber, and use that control to stifle competition and restrain trade. Before Judge LaBuy was to have taken the case under consideration for a ruling, the government, on January 9, was to have filed its findings of legal facts. The defense will do the same by February 5. Thereafter, both sides will have until February 26 to file reply briefs.

Judge LaBuy has not indicated when he might give his decision. Attorneys involved in the litigation said they believe he will require at least six months to study the huge volume of exhibits before reaching a decision.

Offering Tubeless Tires

Firestone Tire & Rubber Co. has announced that it is supplying the Packard Motor Car Co. with tubeless tires that the auto manufacturer is currently offering as optional equipment on 1954 models. Packard is the first auto manufacturer to make the tubeless tires available as original equipment. Tubeless tires have been produced for the replacement market for the past six years. It is estimated that about 3,500,000 of these tires are now mounted on cars, or less than 1% of all tires in use. Firestone and Goodrich are presently producing these tires, and other manufacturers have been building and testing experimental tires of this type. Some believe that Packard's adoption of the tubeless tire as optional equipment may spur other tire manufacturers to enter the field.

Adopts Profit-Sharing Plan

Ace Rubber Products, Inc. of Akron, Ohio, and the United Rubber Workers, C.I.O., have signed a new agreement calling for a profit-sharing plan and increased insurance benefits for employees and their families. Approximately 100 employees are covered by the agreemnt which provides an increase of about 9c an hour in benefits. The 9c covers the insurance improvements and the profit-sharing plan. The agreement is retroactive to October 1, with employees participating in profit-sharing for the last quarter of 1953 and the year ending in 1954. The contract, which was to have expired on March 1, 1954, was reopened for wage talks only. The profit-sharing plan was agreed to in lieu of wages.

Heads Natural Rubber Bureau

H. C. Bugbee

Effective January 1, 1954, H. C. Bugbee, previously vice-president of the Natural Rubber Bureau, became president of that organization. In his new post, Mr. Bugbee succeeds W. S. Lockwood, who resigned to form Warren S. Lockwood Associates, a firm specializing in international public relations. Mr. Bugbee has spent his entire business career in rubber and is well known in international commodity circles. Before joining the Bureau in 1947, he spent many years in Malaya in charge of B. F. Goodrich's Singapore office and in Akron as manager of Goodrich's Rubber Purchasing Division. Mr. Bugbee has also had extensive experience with the government. In Washington, he acted as selling agent for the Rubber Reserve Company of the Reconstruction Finance Corporation. During the later war years, Mr. Bugbee was in London as American Commodities Attache at the U. S. Embassy. Mr. Bugbee pointed out that there would be no change in Bureau organization or activities. He went on to say that the Natural Rubber Bureau, which was established by the rubber growers of Southeast Asia, would continue its efforts to expand the use of natural rubber in the United States.

Monsanto Offers New Activator

Experimental quantities of phenylcyclohexyl hydroperoxide, which is said to have shown excellent results as an activator for GR-S cold rubber formulations, are now available from the Phosphate Division of the Monsanto Chemical Co., St. Louis, Mo. The new product, a yellowish liquid containing 20% of the hydroperoxide, also may be good as a polymerization catalyst for other applications such as styrenated polyesters, according to Monsanto. Recent tests, it was reported, have produced polymerization recipes for preparation of cold GR-S rubber in less than twenty minutes at 41° F.—many times faster than the ordinary processes.

Reduction in the price of glacial methacrylic acid has been announced by Rohm & Haas. The new price of 74½c per pound compares with a former development price of 95c a pound.

New Ammonia Division

Shell Chemical Corp. has formed an Ammonia Division effective January 1, to handle the manufacture, distribution and sale of this chemical vital to agriculture and industry. Headquarters of the new division will be San Francisco. Its formation follows the opening December 11 of the new Shell Chemical ammonia plant at Ventura, Calif., which strengthened the company's position as the largest producer of anhydrous ammonia and ammonium sulfate west of the Rockies.

G. R. Monkhouse, vice-president of the company, has been appointed to head the new division. L. M. Roberts, general manager of manufacturing in the company's New York headquarters, will go to San Francisco as the new division's operations manager in charge of manufacturing, distribution, and marketing engineering. In this position he will have direct charge of the company's two ammonia plants—the pioneer plant, at Pittsburg, California, which has been operating since 1931, and the recently opened plant at Ventura. V. C. Irvine has been designated sales manager of the Ammonia Division. In addition to their new duties in the Ammonia Division, Messrs. Monkhouse and Irvine will continue as manager and sales manager, respectively, of Shell Chemical's western division which handles sales of all other Shell Chemical products.

Hycar 1012X41 Nitrile Polymer

Hycar 1012X41, a liquid nitrile polymer which is an excellent non-migrating, non-volatile, non-extractable plasticizer for rubber and plastic compounds, is now available in commercial quantities, according to a recent announcement by the B. F. Goodrich Chemical Co. When used in nitrile rubber recipes, Hycar 1012X41 improves flow, extrusion and calendering properties and produces compounds with excellent building and knitting characteristics. Stocks containing liquid Hycar have normal tack at room temperatures but become very tacky at temperatures above 120° F.

Hycar 1012X41 exhibits normal softening action on cured nitrile stocks; however relatively small amounts of Hycar 1012X41 sharply reduce the viscosity of uncured gums. This approaches a peptizing action and may be of considerable interest to those engaged in the manufacture of nitrile rubber sponge. Although it does not vulcanize easily, Hycar 1012X41 does absorb some sulfur which retards the curing of stock slightly. Vinyl plastisol compounding is another area in which the initial work with Hycar 1012X41 has produced excellent results.

New Dow Vinyltoluene Plant

According to the Dow Chemical Co., a new plant for the manufacture of vinyltoluene will shortly be in production in Midland, Mich. Vinyltoluene, the latest in a series of Dow monomers, is similar to styrene in chemical behavior and is expected to offer improved products in the fields of synthetic rubber paint vehicles, rubber reinforcing resins, polyester resins, and molding powders.

Joins Chemical Rubber Products

Bernard S. Liquorman

Bernard S. Liquorman, formerly plant engineer at Vulcan Rubber Products, Inc., has been appointed plant engineer of Chemical Rubber Products, Inc., Beacon, N. Y. Prior to his association with Vulcan Rubber Products, he was a design engineer for the M. W. Kellogg Co. and the Doeh Development Co. He is a graduate of New York University with a master's degree in mechanical enginering and a bachelor's degree in aeronautical engineering. He holds a New York State engineering license.

Alfco Hose Shut-Off Unit

A new 3-in-one hose shut-off device has been introduced by the American-La-France-Foamite Corp. of Elmira, N. Y. The "Alfco Hose Shut-Off" can be used effectively on 1½, 2½ and 3-inch double-jacket fire hose. It can be switched from one hose line to another in only the time it takes to operate the hand lever—no adjustments of any kind are necessary. A downward pressure on the operating lever securely locks the device in place. Less effort is required to shut off a charged line as body weight can be utilized in the downward thrust. A lightweight and compact unit, the Alfco Hose Shut-Off is but 27½ inches long and weighs 16 pounds. The unit is made of steel, with a weather-resisting paint finish. Cadmium-finished brackets are available for mounting purposes.

Slated Production Rise

Shawinigan Resins Corp., Springfield, Mass., has announced plans to expand production of polyvinyl butyral for the second time in less than a year. R. K. Mueller, Shawinigan president, said the capacity increase will enable the plant to meet the demand anticipated for the next three years. The new program will boost capacity about 20%, he said. A 35% production increase, announced last April, was completed recently.

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FORT WAYNE HEARS MARTIN ON INJECTION MOLDING OF VINYL

The second meeting of the 1953-54 season of the Fort Wayne Rubber and Plastics Group was held at the Van Orman Hotel in Fort Wayne, Ind., on December 3, with 165 members and guests in attendance. Principal speaker of the meeting was Frank Martin, director of the rubber and plastics laboratory of the Hoover Co., North Canton, Ohio. Mr. Martin spoke on "The Injection Molding of Vinyl Materials." His talk was illustrated by slides.

Mr. Martin observed that the molding of elastomeric vinyls offers a fertile field to the custom molder. The surface of this field has only been scratched, he declared. These materials can compete with rubber in many applications, and bring to those applications the plus factor of better appearance, better aging, and lower costs.

There are numerous troublesome factors involved in molding PVC, most of these factors stemming from the poor thermal stability and low heat conductivity which make uniform plasticizing action difficult to obtain. However, the use of restricted flow techniques in the nozzle and gates to generate flash heat aids materially in the plasticizing problem, he said.

The screw pre-plasticizing type of machine promises to give the desired plasticizing action with freedom from thermal decomposition, and at a greatly increased rate. Dry-blend compounds mixed in the molder's plant offer a big saving in material cost, and increased safety as regards burning. These dry blends are readily handled by the screw type plasticizing machine, and can also be molded in conventional machines with some slight modifications.

Mr. Martin predicted that the next several years will see greatly increased activity in the molding of elastomeric PVC. With this increased activity will come new techniques in compounding and in molding, he concluded.

Philadelphia Holds Meeting

The November 13, 1953, meeting of the Philadelphia Rubber Group was held at the Poor Richard Club in Philadelphia, Penna., and was attended by approximately 165 members and guests. The dinner was preceded by an informal cocktail hour. Principal speakers of the evening were G. L. Bruggemeier of the Firestone Tire & Rubber Co., and R. H. Wattleworth of the B. F. Goodrich Co. Their topic was "Mixing and Extruding Methods and Equipment."

ASTM Committee Week Features

The 1954 Committee Week of the American Society for Testing Materials to be held from February 1 to 5, inclusive, at the Shoreham Hotel in Washington, D. C., will feature the meetings of forty main technical committees and their subcommittees. The Sheraton Park Hotel is cooperating with the Shoreham in providing meeting rooms and accommodations. Committee D-11 on Rubber and Rubberlike Materials will meet during this period.

Coming Events in the Rubber Industry

Jan. 24. Philadelphia Rubber Group, Poor Richard Club, Philadelphia, Penna.

Jan. 27-29. Society of Plastics Engineers, Inc., Tenth Annual National Technical Conference, Royal York Hotel, Toronto, Ont., Canada.

Jan. 29. Akron Rubber Group, Winter Meeting, Mayflower Hotel, Akron, Ohio.

Feb. 2. Los Angeles Rubber Group, Statler Hotel, Los Angeles, Calif.

Feb. 5. Chicago Rubber Group, Congress Hotel, Chicago, Ill.

Feb. 11. Fort Wayne Rubber & Plastics Group, Hotel Van Orman, Fort Wayne, Ind.

Feb. 12. Connecticut Rubber Group, Bridgeport, Conn.

Feb. 12. Detroit Rubber & Plastics Group, Detroit-Leland Hotel, Detroit, Mich.

Feb. 17. Washington Rubber Group.

Mar. 2. Los Angeles Rubber Group, Statler Hotel, Los Angeles, Calif.

Mar. 17. Washington Rubber Group.

Mar. 26. Boston Rubber Group, Spring Meeting, Hotel Somerset, Boston, Mass.

Mar. 26. Chicago Rubber Group, Furniture Mart, Chicago, Ill.

Apr. 2. Akron Rubber Group, Spring Meeting, Mayflower Hotel, Akron, Ohio.

Apr. 6. Los Angeles Rubber Group, Statler Hotel, Los Angeles, Calif.

Apr. 8. Fort Wayne Rubber & Plastics Group, Hotel Van Orman, Fort Wayne, Ind.

Apr. 9. Detroit Rubber & Plastics Group, Detroit-Leland Hotel, Detroit, Mich.

Apr. 14-16. Rubber Division, A.C.S., Spring Meeting, Hotel Brown, Louisville, Ky.

Apr. 21. Washington Rubber Group.

Apr. 30. Chicago Rubber Group, Furniture Mart, Chicago, Ill.

May 4. Los Angeles Rubber Group, Statler Hotel, Los Angeles, Calif.

May 14. Connecticut Rubber Group.

May 19. Washington Rubber Group.

June 12-13. Los Angeles Rubber Group, Outing, Miramar Hotel, Santa Barbara, Calif.

June 18. Akron Rubber Group, Summer Outing.

June 18. Boston Rubber Group, Summer Outing.

June 22-25. Institution of the Rubber Industry, Third Rubber Technology Conference, London, England.

June 25. Detroit Rubber & Plastics Group, Summer Outing.

Sept. 15-17. Rubber Division, A.C.S., Fall Meeting, Hotel Commodore, New York, N. Y.

Sept. 18. Connecticut Rubber Group.

Oct. 5. Los Angeles Rubber Group, Statler Hotel, Los Angeles, Calif.

Oct. 8. Detroit Rubber & Plastics Group, Detroit-Leland Hotel, Detroit, Mich.

Oct. 15. Boston Rubber Group, Fall Meeting, Hotel Somerset, Boston, Mass.

Nov. 3. Los Angeles Rubber Group, Statler Hotel, Los Angeles, Calif.

Dec. 3. Los Angeles Rubber Group, Xmas Party, Ambassador Hotel, Los Angeles, Calif.

Dec. 10. Boston Rubber Group, Xmas Party, Hotel Somerset, Boston, Mass.

Dec. 10. Detroit Rubber & Plastics Group, Sheraton Cadillac Hotel, Detroit, Mich.

Vittone Named Plant Manager

Anton Vittone, Jr.

Anton Vittone, Jr. has been named plant manager of the experimental station operated by the B. F. Goodrich Chemical Co. at Avon Lake, Ohio. Mr. Vittone succeeds Harry B. Warner, who was recently named vice-president, technical, of the company. Mr. Vittone comes to Avon Lake from the Institute, West Va., synthetic rubber plant where he was plant manager. The Institute plant, operated for the government by Goodrich Chemical, is currently being put in standby condition by the company. Mr. Vittone joined the Goodrich organization in 1942 as a shift foreman at the GR-S plant in Louisville, Ky., and in 1947 was transferred to the Geon polyvinyl chloride plastic resin plant in the same city as a general foreman. He held various assignments with the company both here and abroad before being sent to Institute in 1950 as production manager of the plant. He was named plant engineer a year later, and in 1952 became plant manager. Mr. Vittone was graduated from the University of Washington with a B.S. degree in chemical engineering, and received his M.S. degree in chemical engineering from the same university in 1939. He is a member of the American Institute of Chemical Engineers and the American Chemical Society.

To Open San Francisco Office

Arthur D. Little, Inc. of Cambridge, Mass., will open a western regional sales office in San Francisco, Calif., early in 1954. C. J. Matthew, a long-term employe of the company in Cambridge, will be in charge of the new office with R. Newhall of San Francisco as an associate. They will provide liaison with the company's main research organization in Cambridge, Mass. The company was established in 1886 and is today one of the largest and most diversified of the nation's private research and consulting organizations.

Campbell Sons' Name Royal

J. J. Harrison, general manager of the Calcium Carbonate Division of Harry T. Campbell Sons' Corp., Baltimore, Md., has announced the appointment of H. M. Royal Inc., 689 Pennington Ave., Trenton, New Jersey, as sales representative for the state of New Jersey.

News in Brief

Quaker Rubber has announced a new full color bulletin on its complete line of plastic and rubber lawn hoses. Each of the hoses is described by means of photographs and cross-section views.

A new technical service bulletin giving up-to-date information about the importation and processing of natural gum karaya is now available from the Natural Gum Department of Morningstar, Nicol, Inc., New York, N. Y.

The White Pigments Division of Godfrey L. Cabot, Inc., Boston, Mass., has announced the appointment of B. F. Wagner & Co., Pasadena, Calif., as representatives for sales of wollastonite in the ceramics industry in California.

A disposable paper work cap has been developed in which heavy Kraft paper has been treated with neoprene providing a product of exceptional durability.

Geon vinyl plastic film storm windows fastening on the inside of the window frame are now being manufactured by the Clopay Corp., Cincinnati, Ohio.

Methods for the evaluation of plastic pipe will be established in an extensive engineering research program which began on December 1, at the Battelle Memorial Institute, Columbus, Ohio.

Sprague Engineering & Sales Corp., Gardena, Calif., has issued a new bulletin on its S-214 series of automatic shut-off valves for the protection of gauges and instruments in hydraulic or pneumatic systems against overloads.

New, easy-to-install weather stripping for windows, doors, storm sashes and screens is being made of Bakelite vinyl resin-base plastisols by the Schlegel Manufacturing Co. of Rochester, N. Y.

Quaker Rubber has released a new full-color bulletin describing the many types of water hose now available from the company.

A new brochure, "A Few Case Histories," which contains a random sampling of cases in which Arthur D. Little, Inc., Cambridge, Mass., has participated, is now available from the company.

A handy key to the latest information about more than 50 Bakelite and Vinylite plastics and resins, their properties and uses, is presented in a new revised reference file published by the Bakelite Co.

Pittsburgh Plate Glass Co. has leased the entire tenth floor, for New York sales offices, in a new 15-story building now under construction at 579 Fifth Ave., New York, N. Y. The new quarters will provide room for the company's wholly-owned subsidiary, Columbia-Southern Chemical Corp., and an affiliate, Pittsburgh Corning Corp. Present New York offices for the three companies are now located at 30 Rockefeller Plaza.

Named Silastic Sales Engineer

Douglas B. Moore

Douglas B. Moore has been appointed Silastic sales engineer for the Chicago office of Dow Corning Corp., according to an announcement by R. S. Naegele, manager of Silastic sales for the corporation. Mr. Moore, who for two years specialized in silicone rubber while serving as assistant technical service manager at the Connecticut Hard Rubber Co. before joining Dow Corning, recently completed several months training in the corporation's Silastic development and production laboratories located in Midland, Mich. In his new position he will work with both rubber fabricators and their customers providing technical service and assistance. Mr. Moore is a graduate of Pennsylvania State College, receiving a bachelor of science degree in 1942. Following his graduation he was employed as a rubber chemist by the Hewitt Rubber Division of Hewitt-Robins Inc. In 1947, Mr. Moore joined the Pawling Rubber Corporation and served as sales representative in the corporation's Detroit office.

Anaconda Expands on West Coast

Anaconda Wire & Cable Co., N. Y., is completing a $700,000 expansion program at its Orange, Calif., mill. The project is expected to increase production of copper products at that plant by 15%. It involves the construction of a 40,000 square foot factory building, the revamping of the electrical power system, and the installation and rearrangement of $250,000 worth of mechanical equipment. The wire mill will consist of over 40 machines for drawing and processing copper wire from fine sizes up to 3 inches in diameter when stranded.

Aero Maleic Anhydride

American Cyanamid Co. has announced that it will market "Aero Maleic Anhydride" in briquette form, beginning January 1. The chemical is a highly reactive intermediate used in the production of rubber chemicals, synthetic resins, surface active agents, plasticizers, etc.

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Seamless Rubber Promotes Gow

Arthur R. Gow

Arthur R. Gow has been named president of the Seamless Rubber Co., New Haven, Conn., succeeding F. Thatcher Lane, who has been named chairman of the board of directors of the company. Mr. Gow had been executive vice-president of Seamless Rubber since 1950. Prior to that date, he was vice-president and factory manager. On January 1st, he completed 25 years with the company, said to be the world's largest manufacturer of rubber drug sundries. In addition, the company manufactures rubber surgical and hospital specialties, bathing caps, adhesive plaster, industrial tapes and athletic products. Mr. Gow started with Seamless Rubber in 1929, following a brief period with the Hood Rubber Co., of Watertown, Mass. A graduate of Dartmouth College, he is a native of Brookline, Massachusetts.

Mr. Lane had been president of Seamless Rubber since 1933, having a record with the company of more than 34 years. He is a graduate of Yale University. At the same time, announcement was made of the promotion of William B. Watson to the position of vice-president and factory manager. He had been assistant vice-president and factory manager since April, 1952. Mr. Watson started as a trainee at Seamless Rubber in 1946, and held various production assignments until his appointment as factory manager in 1950. Mr. Watson is a graduate of Yale University.

Bondmaster Foam Adhesive

A new, white, one-part adhesive for foam rubber splicing, where tack loss is essential and exceptionally soft seam is desired, has been developed by Rubber & Asbestos Corp., Bloomfield, N. J. The new adhesive, trade named "Bondmaster 19 White," features a quicker "grab" than previously existing formulations and is claimed, because of its embodied pigments, to permit an almost invisible seam, thereby eliminating the ugly dark line normally found when pillows, mattresses, seats, and similar foam rubber products are bonded. The new product, which completely loses its tack within four hours after application, is said to retain softness even in heavy seams or on outside perimeter bonding.

Rubber Manufacturing in India

Cecil Stack, chairman of the Association of Rubber Manufacturers in India and managing director of the Dunlop Rubber Co. (India) Ltd., in a recent address at the general annual meeting of the association in Calcutta, stated that 1953 had been a satisfactory year for the rubber industry in India. Latex foam, he said, is meeting wide acceptance as a cushioning material in that country. Plant capacities for the manufacture of friction surface rubber transmission belting and endless cable cord V-belts are now sufficient to meet India's requirements. A plant has been imported for the manufacture of tennis balls and plans for production are now under way. Prospects for the future, Mr. Stack said, are very encouraging. India's Five Year Plan provides for considerable road development, and prospects for the rubber industry based on this program are good. One of the major problems of 1953 was an over-abundance of raw rubber. Producers at one time were pressing the government to export 1,500 tons. In the latter part of the year, however, consumption exceeded production, with the result that the surplus was reduced. Considerable progress has been made during the year by the Indian Standards Institution with the help of representatives of the association to draw up minimum specifications for indigenous chemicals used in the rubber manufacturing industry, Mr. Stack reported.

"Disappearing" Adhesive Developed

The "Unitized" oil ring recently developed by the Muskegon Piston Ring Co., with an assist from the Adhesives and Coatings Division of the Minnesota Mining & Manufacturing Co., enables a multi-piece oil ring to be handled as a single unit for production line assembly. In tackling the problem, an adhesive was needed for joining two steel rails to a corrugated steel spacer to produce a single unit oil ring. Minnesota Mining produced a possible answer in a rubber-based flexible adhesive that is oil soluble. Tests results show that the adhesive completely dissolves and disappears within 300 to 500 miles of driving. Changing the oil in the engine after 500 miles drains all of the dissolved adhesive from the crankcase and leaves each component part of the oil ring operating independently of the other two.

Plans March Meetings

Nearing the completion of its tenth year, the Division of High-Polymer Physics of the American Physical Society will hold its twelfth meeting at Detroit and Ann Arbor, Mich., on March 18, 19 and 20, 1954, marking the anniversary. The division was inaugurated at a meeting at Rochester, N. Y., in June, 1944. At the forthcoming meeting a symposium on the "Properties of Amorphous Polymers in Bulk" is scheduled, along with other invited and contributed papers. The program has been arranged by a committee headed by Dr. T. G. Fox.

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Hagberg Joins S. S. Skelton

Ralph A. Hagberg

S. S. Skelton Co., Cleveland, Ohio, has announced that Ralph A. Hagberg has joined their organization. Mr. Hagberg served with the Industrial Chemical Sales Division of the West Virginia Pulp and Paper Co. for seventeen years, starting as a research chemical engineer, then as a technical service man, and then as a technical representative in the New York, New Jersey, and New England areas. After his World War II service, he became manager of their Cleveland office, handling their by-product chemicals including activated carbon, tall oil products, terpenes, cellulose products, and lignin in the Ohio-Michigan area catering principally to the rubber, paint, and water works fields. The S. S. Skelton Co., headquartered in Cleveland at 2775 South Moreland Blvd., and with a branch office in Akron at 68 East Mill St., handles a diversified line of chemicals for the paint, rubber, and chemical industries; they are also planning to take on a line of water purification chemicals in the near future.

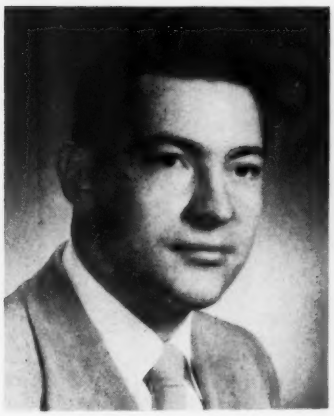
Mona Introduces Monawet MO

Mona Industries, Inc., Paterson, N. J., has begun the manufacture of "Monawet MO", a wetting agent of the dioctyl sodium sulfosuccinate type. Useful for the preparation of dispersions and emulsions, the product is the sodium salt of the di-(2-ethylhexyl)-sulfosuccinic acid, a compound known for its outstanding wetting and penetrating power. The company states that Monawet MO is stable indefinitely in neutral, cold or hot water solutions. The stability is likewise very good in solutions between a pH range from 5 to 9. The product is available in various forms and concentrations for easy handling and for reasons of economy.

Uhlich Appoints Summit

Paul Uhlich & Co., Inc., pigment color manufacturers with offices at 90 West St., New York 6, N. Y., and a manufacturing plant in Brooklyn, N. Y., has announced the appointment of W. D. Anderson and H. B. Headley of the Summit Chemical Co., 10½ South High St., Akron 8, Ohio, as sales representatives for the rubber industry.

Cooperman Joins Nuodex



Norman L. Cooperman

Nuodex Products Co., Inc., Elizabeth, N. J., has announced the appointment of Norman L. Cooperman as technical service manager of the Vinyl Department. Prior to joining Nuodex, Mr. Cooperman was for seven years head of the Rubber and Plastics Department of Thompson-Weinman & Co., Montclair, N. J., where he acted in a technical sales capacity throughout the eastern United States and Canada. He thus brings to Nuodex customers in the vinyl fungicide, stabilizer, and other additive fields an intimate knowledge of the requirements of the vinyl industry. During World War II, Mr. Cooperman served with the Medical Corps in the Southwest Pacific theater of operations. He received his degree of B.S. in Chemistry from Rutgers University in 1943.

RMA Revising Regulations

A subcommittee of the Crude Rubber Committee of the Rubber Manufacturers Association is reviewing the 1938 edition of "Rules and Regulations Covering Transactions Between Sellers and Factory Buyers in Crude Rubber," to determine whether revision and reprinting is in order at this time. Since it has been fifteen years since these rules were adopted by RMA, the subcommittee was directed to re-examine them carefully with a view to determining what if any revisions might be needed to meet changed conditions in world markets and trade. Chairman of this committee is E. C. Schwab, head of the Rubber Purchasing Division of the U. S. Rubber Co., and author of the RMA Quality Seminar chapter on "Methods of Purchasing Crude Rubber."

Heads United Carbon Co.

Thorne F. Koblegard has been elected president of the United Carbon Co. and its subsidiaries, succeeding the late Oscar Nelson who had been president of the company since its organization. Oscar Nelson, Jr., has been elected chairman of the Executive Committee. Mr. Koblegard formerly was first vice-president of the company while Mr. Nelson is executive vice-president.

Enters Institutional Field

Entry as a manufacturer into the institutional product field has just been announced by the Wooster Rubber Co., Wooster, Ohio. Beginning with the marketing of a heavy duty bathtub mat for use in institutions, hotels, motels, etc., the company expects to develop a range of institutional products along the lines of its more than 70 houseware items, which include special and general purpose mats and trays for bathroom and kitchen, dish drainers, drainboard trays and other kitchen equipment and tools. Donald W. Moorhead, who headed company research efforts to determine trade needs in this field, will be in charge of Wooster Rubber's new sales department for institutional products. Mr. Moorhead was a member of the sales force of the International Paper Sales Co. prior to joining Wooster Rubber in 1952. Mr. Moorhead said that the company's first institutional product, the "Rubbermaid" heavy duty bath mat will be released for national distribution soon. The new heavy duty mat is made of a special, strong compound to withstand the greater wear and tear in institutions. Giant vacuum cups on the mat grip the bottom of the tub securely to insure safe footing and prevent skids.

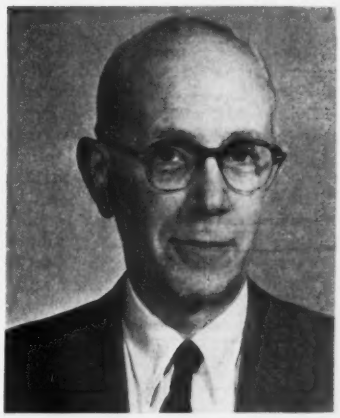
Producing Frasch Process Sulfur

Standard Sulphur Co., New York, N. Y., has announced that it has begun production of crude sulfur by the Frasch Process at its new plant at Damon, Texas. The new plant is now producing sulfur which is 99.5% pure, or better, at a rate exceeding 200 tons per day. The sulfur is of a bright yellow color. Standard Sulphur is said to be the first new company since 1935 to produce the material by means of the Frasch Process and the fifth producer of sulfur by this method in the United States. The company's leasehold at Damon consists of more than 800 acres. Approximately 150 acres have been explored to date, indicating the presence of almost 2,000,000 tons of sulfur. This reserve should be materially increased with the expansion of exploratory work over the balance of the leasehold. The company expected to begin shipments during January.

Firestone Sets Safety Record

A new record for industrial safety in the rubber industry has been set by the Memphis, Tenn., tire plant of the Firestone Tire & Rubber Co., Ned H. Dearborn, president of the National Safety Council, announced on Christmas Eve. As the Firestone plant shut down for the Christmas holiday week end, it had completed 7,103,472 man-hours of work without a single lost-time accident. The new safety mark breaks the previous rubber industry safety record of almost six and one-half million hours which was established by one of Firestone's two tire plants in Akron last June. The 4,000 men and women responsible for the new safety record have worked for 10 months and one day—since February 23, 1953—without a lost-time accident.

Dunlop Tire Promotes Elden



Howard E. Elden

Howard E. Elden has been elected vice-president in charge of manufacturing, research and development of the Dunlop Tire and Rubber Corp., Buffalo, N. Y. Mr. Elden joined Dunlop Tire thirty years ago. He was made technical manager in 1932 and placed in charge of research and development in 1950. He was chairman of the Tire and Tube Technical Consulting Committee to various branches of the government from 1944 to 1948. Mr. Elden is a Fellow of the Institution of the Rubber Industry and holds membership in the American Chemical Society and the Society of Automotive Engineers.

Texstar Non-Woven Fabric

"Nylon Texstar," a new, non-woven fabric with extensive industrial possibilities, has been developed in the laboratories of Star Woolen Co., Cohoes, N. Y., and is now in full production. "Texstar" was designed primarily to replace interlinings and innerfacings in various items of clothing, but its industrial applications seem limitless. It has all the desirable qualities of nylon and yet its price is only a small fraction of a woven fabric. Interest has already been shown in the filtering field, where resistance to strong chemicals is essential, and as backing material, where strength is an important factor. Almost featherweight, Texstar's tear strength is very high, it stitches perfectly, is completely washable and equally strong wet or dry. It can be made soft or stiff, light or heavy, as specified, and is now being produced in a standard 38 inch width. The host of suggested uses includes gaskets, filters, backing for abrasives, shoe linings or stiffeners, etc.

New Daxad Specifications Sheets

The Organic Chemicals Division of the Dewey & Almy Chemical Co., Cambridge, Mass., has issued a new series of specification sheets covering "Daxad" dispersing agents. The specification sheets cover Daxad 11, 11SPN, 21, 23 and 27. Typical properties for each of the materials are outlined. The sheets are available on request to the company.

Personnel Changes at Cyanamid

K. C. Towe, president of the American Cyanamid Co., has announced that several changes have been made in the managerial organization of the company, effective January 1, 1954. Kenneth H. Klipstein has been appointed general manager of the newly-created Research Division of the company. This division will be solely responsible for the operation of the Stamford Research Laboratories under the direction of Dr. J. T. Thurston. It will also supervise other research and development programs which are not the direct responsibility of operating divisions; and will coordinate these programs with related activities of the operating divisions. A new division known as the Organic Chemicals Division has been organized. L. C. Duncan has been named general manager of this division and V. E. Atkins, assistant general manager. The Organic Chemicals Division will merge and consolidate the activities of the Petrochemicals Division with those of the Calco Chemical Division. A new Pigments Division will be responsible for the production and sale of titanium dioxide and other pigments formerly handled by the Calco Chemical Division. J. Allengaert has been named general manager and A. B. Hettrick, assistant general manager, of this division. These changes make it possible for S. C. Moody, vice-president and Dr. R. C. Swain, also vice-president, to devote all their time to general staff matters and to assist in the determination of company policy.

U. S. Rubber Promotes Bonn

Douglas K. Bonn has been named by the U. S. Rubber Co. to head its government department in Washington, D. C. Mr. Bonn, who became assistant manager of the department in 1952, succeeds the late Joseph E. Mathie, who had managed the department from January, 1950, until his death recently. A graduate of the Wharton School of Business of the University of Pennsylvania, Mr. Bonn joined U. S. Rubber in 1937 as a statistical clerk in the Baltimore branch of the Tire Division. The following year he became assistant to the district sales manager and, in 1942, he was transferred to the War Products Division as a special representative to service government contracts. In 1945, Mr. Bonn moved to the Washington office which was renamed the government department after World War II.

Opens Petrochemical Plant

The Semet-Solvay Petrochemical Division of the Allied Chemical & Dye Corp., has announced the opening of its new Niagara River Petrochemical Plant at Tonawanda, N. Y., for the production of polyethylene products. The ethylene is derived from gas which is produced from fuel oil in equipment designed and erected by the Semet-Solvay Engineering Division. This is said to be an innovation in the petrochemical industry, as most plants have been built near natural gas lines. Production is estimated at 20,000,000 pounds annually.

Reports on Quality Claims

The Rubber Manufacturers Association reports that as of September 30, 1953, the total outstanding quality and condition claims against Far Eastern shippers stood at $558,525. This, said RMA, is a decided improvement from the figure of $1,459,461 as of June 30, 1952. Included in the latter figure was $351,597 of claims outstanding prior to January 1, 1951. RMA has been informed that these old claims have now been considered uncollectable and are not included in the September 30, 1953 total. These figures indicate the magnitude of the natural rubber quality problem and the uncollectable figure represents actual losses sustained by importers of natural rubber.

ASTM Corrosion Committee Meets

The Advisory Committee on Corrosion of the American Society for Testing Materials at a meeting held recently at the site of the International Nickel Co. Harbor Island Test Station at Wrightsville Beach, N. C., took action to expand its test site facilities. It has been said that a billion dollars is a conservative estimate of the loss each year due to the corrosion of metals. The effects of atmospheric deterioration on rubber, plastics, wood, textiles, and other engineering materials would more than double this figure. Growing demands within the ASTM and from a number of groups outside the organization has necessitated the current program of test site expansion.

Masonry Paint Potential

The Sales Research Department of the Goodyear Tire & Rubber Co. has just completed an extensive survey of the potential market for exterior masonry paint. The survey showed that in 1950, the market for these paints was 4,700,000 gallons. It is estimated that in 1960, 10,000,000 gallons will be consumed, while in 1975 the market is placed at 17,400,000 gallons.

LOS ANGELES NEWS

The Los Angeles Rubber Group has announced the results of the election for the 1954 officers of the group. The following members have been elected for the new season: *Chairman*, L. E. Budnick (Ohio Rubber); *Associate Chairman*, F. C. Johnston (Caram Mfg.); *Vice-Chairman*, C. S. Hoglund (R. D. Abbott); *Treasurer*, W. M. Anderson (Gross Mfg.); *Secretary*, A. H. Federico (C. P. Hall). B. R. Snyder (R. T. Vanderbilt), W. A. Fairclough (Naugatuck Chemical), and T. W. Andrews (H. M. Royal) were elected directors of the group.

Akron Carbon Black Symposium

The symposium on "Carbon Blacks" which will be held by the Akron Rubber Group on January 29 at the Mayflower Hotel in Akron, Ohio, will feature a panel of experts who will address the group on various phases of the subject. The titles of the papers and the authors follow:

"The Manufacture of Channel, Gas Furnace and Oil Furnace Carbon Blacks," by C. A. Carlton, J. M. Huber Corp.

"The Use and Application of Thermal Blacks in Various Rubber Hydrocarbons," by G. C. Maassen, R. T. Vanderbilt Co.

"The Use and Application of HAF Black in Various Rubber Hydrocarbons," by Merton Studebaker, Phillips Chemical Co.

"The Use and Application of Channel Blacks in Various Rubber Hydrocarbons," by Larry Sperberg, Sid Richardson Carbon Co.

"The Use and Application of HMF Blacks in Various Rubber Hydrocarbons," by Leslie Carver, Witco Chemical Co.

"The Use and Application of SRF Blacks in Various Rubber Hydrocarbons," by I. Drogin, United Carbon Co.

"The Use and Application of SRF Blacks in Various Rubber Hydrocarbons," by John W. Snyder, Binney & Smith Co.

"The Use and Application of FEF Blacks in Various Rubber Hydrocarbons," by F. H. Amon, Godfrey L. Cabot, Inc.

Concludes British Agreement

Hewitt-Robins Inc., Stamford, Conn., has concluded an agreement with Greengate & Irwell of Manchester, England, the largest manufacturer of conveyor belting in the United Kingdom, under which Greengate & Irwell will manufacture, to Hewitt-Robins' specifications and with exchange of "know-how," special types of conveyor belting and other heavy-duty industrial rubber products, including petroleum industry hose. A new Hewitt-Robins subsidiary, Hewitt-Robins (Great Britain) Ltd., will be created to handle export sales from Great Britain. Greengate & Irwell will handle sales in the British Isles. Harold Von Thaden, vice-president, who heads the company's International Division, said this step is part of a program to make the company's products more readily available to overseas customers from foreign affiliates as well as the Hewitt-Robins industrial rubber plant in Buffalo, N. Y.

RCA "Epox-S" Plasticizer

Rubber Corporation of America, Brooklyn, N. Y., has introduced "Epox-S," an epoxidized triester plasticizer of higher than usual molecular weight for outstanding permanence, heat and light stability and ease of processing. The product is said to possess desirable properties of both the more familiar monomeric esters and the true polymeric types. The epoxy-oxygen content adds stabilizing action when used with vinyl resins and the low order of unsaturation, the company states, assures compatibility. Its low viscosity allows for easy handling, while its high molecular weight reduces migration.

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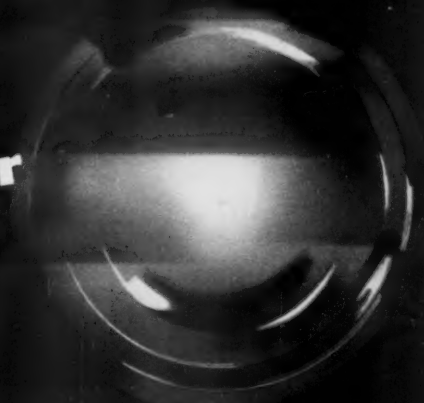

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NAMES IN THE NEWS

CHARLES S. PYNE, associated with the Goodyear Tire & Rubber Co. since 1951, has been added to the mid-west territory of the company's Chemical Sales Division.

EARL C. LENZ, formerly vice-president and general sales manager of Paisley Products, Inc., subsidiary of Morningstar, Nicol, Inc., has been elected vice-president of sales and advertising for the parent company and all its subsidiaries.

ALBERT C. MCCOY has been named vice-president and general manager of the Masland Duraleather Co., and will be in full charge of all company operations.

DR. R. P. DINSMORE, vice-president in charge of research and development for the Goodyear Tire & Rubber Co., has been elected a director of the American Institute of Chemical Engineers.

DR. HAROLD T. BYCK, assistant to the president of the Shell Development Co., has been elected chairman of the Division of Colloid Chemistry of the American Chemical Society for 1954.

ROBERT M. AUDE, formerly associated with the Monsanto Chemical Co., has been appointed manager of the Fords, N. J., plant of the Heyden Chemical Corp.

J. M. TOUGH, formerly Chicago district manager for the Watson-Stillman Fittings Division of the H. K. Porter Co., has been appointed sales manager of the division.

W. E. KEMERER, associated with the Firestone Tire & Rubber Co. since 1929, has been named manager of export trade for the Firestone International Co.

P. KAY SCHWARTZ, associated with Proctor & Schwartz, Inc., Philadelphia, Penna., since 1935, has been named president of the company, succeeding THOMAS W. ALLEN, who has retired.

WILLIAM S. RICHARDSON, executive vice-president of the B. F. Goodrich Co., has been elected to the board of trustees of the Case Institute of Technology.

F. T. MAGENNIS, vice-president of the Goodyear Tire & Rubber Export Co., has been awarded the French Legion of Honor in connection with his participation in the work of the International Road Federation.

C. E. BUCHAN, associated with the Electric Machinery Manufacturing Co. of Minneapolis, Minn., for the past 30 years, has been appointed to the newly-created position of general sales manager.

J. D. MCPHERSON, associated with the American Cyanamid Co. since 1945, has been named assitant manager of the Manufacturers Chemicals Department of the Industrial Chemicals Division of the company.

WILLIAM STEED and THOMAS BAIZE have joined the sales staff of the Sharples Chemicals Co. Mr. Steed will represent the company in the Southwest, while Mr. Baize is presently working as sales assistant in the Philadelphia executive offices.

Announces Move of Division

The Rubber and Plastic Division of Sinclair and Valentine, Inc., of 611 West 129th St., New York, N. Y., has moved their plant from that city to 75 Front St., Ridgway, Penna., to allow for increased business. T. G. Sullivan, manager of the division, has moved to the Ridgway plant. The new facilities will be able to produce about three times as much of their dispersed rubber and plastic colors as the old New York plant. Ridgway is now the manufacturing location for all dry, flushed, rubber and plastics colors for the Sinclair and Valentine organization. The Harwick Standard Chemical Co. of Akron, Ohio, is sales agent for products made by the Rubber and Plastic Division.

Berglind Named Purchasing Agent

Promotion of E. G. Berglind to the position of purchasing agent of the Wooster Rubber Co., Wooster, Ohio, has been announced by the company. For the past two years, Mr. Berglind has been assistant purchasing agent, and prior to that was purchasing agent for the Star Drilling Machine Co. of Akron.

Chosen ACS President-Elect

Joel H. Hildebrand, professor emeritus of the University of California, has been chosen president-elect of the American Chemical Society for 1954. This caps his long service to ACS during which he served as councilor-at-large from 1928-30 and 1941-46 and as associate editor of three ACS journals. Dr. Hildebrand recently was resident research associate at the Argonne National Laboratory. He plans to give a course at the University of California during the spring semester and has accepted an invitation to give a two-week lecture course at Yale University next fall. On January 1, Harry L. Fisher, head of the department and professor of rubber technology at the University of Southern California, took office as president.

Baird Redecorates Offices

Baird Rubber & Trading Co., Inc., New York, N. Y., has enlarged and redecorated its offices. Space has been set aside for customers to serve as the visitors' office during a stay in New York. The office is furnished with fine antique furniture.

Sparks to Receive AIC Medal

Dr. William J. Sparks

Dr. William J. Sparks, co-inventor of Butyl rubber, has been selected to receive the 1954 Gold Medal of the American Institute of Chemists. Dr. Sparks is director of the Chemical Division and coordinator of exploratory research for the Standard Oil Development Co. Dr. Sparks has been cited "as an eminent chemist who has striven unceasingly for the promotion of the science of chemistry and the professional advancement of the chemist." The medal will be presented at the Institute's annual meeting in May. Dr. Sparks has been with the Standard Oil Development Co. since 1936, with the exception of the 1939-40 period. During the early period of his experimental work with the company, he played a key role as co-inventor with R. M. Thomas in the development of Butyl. In addition, more than 100 of his chemical inventions have been patented.

Among the other polymers of note which he pioneered were two types which have assumed commercial importance. These included "T-132," a high-styrene-isoprene emulsion copolymer which was the forerunner of the artificial leather and shoe-sole type resins of present importance, and a thermoplastic film-forming copolymer of isobutylene and styrene of low temperature known as "S-Resin."

Dr. Sparks was born on February 26, 1905. He holds M. A. and A. B. degrees from the University of Indiana and a Ph. D. in chemistry from the University of Illinois. Active throughout his career in professional societies, Dr. Sparks has participated in numerous affairs of the AIC and served in 1945 and 1946 as councilor of the New York Section. He has served since 1942 as national councilor of the American Chemical Society. In 1952, he was appointed vice-chairman of the Division of Chemistry and Chemical Technology of the National Research Council and last year was appointed chairman.

Sources of "Kel-F" polymer materials, finished products, as well as application services offered by more than 75 U. S. and Canadian companies, are readily available in a quick-reference buyer's guide issued by the M. W. Kellogg Co., Jersey City, N. J.

PCFA SEES INCREASED ACTIVITY IN VINYL FABRIC FIELD IN '54

Vinyl fabrics shipments in 1954 should show an over-all increase over 1953 in the opinion of member companies of the Plastic Coatings and Film Association who produce a major portion of the nation's yardage of vinyl-coated material and vinyl sheeting. Barring a general business recession, estimates for the first 6 months of 1954 are for an increase in shipments of vinyl-coated fabrics compared to the same period in 1953. Forecasts for shipments of vinyl sheeting set the level for the first half of 1954 at that prevailing during the last 6 months of 1953, down from the first half of the year.

With final figures in for the first 9 months of 1953, the PCFA reports total plastics fabrics shipments, including pyroxylin-coated materials as well as vinyl-coated fabrics and vinyl sheeting running about 13% head of the 9-month figure for 1952. Shipments which dropped off in October and November have picked up again to a point where Association members foresee this percentage increase holding for the year-end totals.

Pyroxylin sales showed an increase for the first time in a number of years. A 15% increase for vinyl fabrics in 1953 over 1952 is attributable to a sizable upsurge in vinyl-coated material usage which more than effects a decline in shipments of heavy-weight vinyl sheeting.

Emphasis on the designing and closely-controlled production of plastic fabrics specially developed to fulfill the use and care requirements of specific markets will play the same dominant role in the industry in 1954 as in 1953, the Association's member survey indicates. Design for design's sake has given place in the industry's thinking to surface effects that are in the high fashion key yet controlled by a studied knowledge of taste and use preference peculiar to each market. The results of this design approach are apparent in current vinyl-coated fabric and vinyl sheeting lines which feature diversity rather than a dominant trend.

Emphasis on Design

Plans of plastic fabrics manufacturers reporting to the PCFA for adding new equipment show this double pre-occupation with surface design and engineering for specific end-use requirements. These companies will be installing processing equipment that is larger, higher speed, more versatile and capable of closer control. Now, machinery for finishing will be weighted on the side of multi-color presses and new embossing equipment.

With few exceptions these 1954 equipment purchases will represent an increased production potential. Only in part will they replace obsolete machines. This is concrete substantiation of the plastic fabrics manufacturers' expressed belief that 1954 shipments will top those of 1953.

Vinyl-coated fabric, the top volume material in the plastic fabric industry, finds its largest outlets in furniture upholstery and automotive applications, according to a majority of Plastic Coatings & Film Association members. New markets have been opening recently—that of men's, women's and children's jackets, for example. Other outlets mentioned as offering greater potentials for these coated materials are industrial applications, folding doors, wall covering.

The percentage of vinyl-coated fabric produced by calendering, laminating, spread coating or casting by any one producer varies considerably, dependent partly on market emphasis and design approach. PCFA reports indicate that, over-all, calendered materials are in the lead. Spread coating, laminating and casting can be used to impart qualities of advantage to a particular market or to the achievement of a particular construction or design effect. Developments in vinyl-coated fabrics center mainly around elasticized backing.

Flat upholstery and auto seat covers are vinyl sheeting's two biggest present markets. The upholstery outlet includes all types of dinette seating—typical kitchen as well as styled-up construction—side chairs, restaurant and bar stools and chairs, hassocks, headboards. The market generally cited as the newest with the greatest potential is the inflatable field.

Calendered Film Predominates

From 90 to 95% of this vinyl sheeting is calendered, according to estimates of PCFA members. The small balance produced by casting is described as going into highly specialized uses, surgical dressings being one example. Producers of vinyl sheeting report a constant demand for new surface effects and colors and have kept these elements in constant view in their development work directed toward improving the inherent properties of the material.

The expressed opinion of manufacturers producing pyroxylin-coated materials continued to be that this material has about found its level—this despite the increased shipments in 1953. Book bindings, shoes, case coverings are listed as major outlets for pyroxylin. Neither the availability of labor nor basic raw materials is expected to present a problem during the coming year.

Plastic fabrics producers list furniture manufacturers in the East, Midwest and South as heavy users of their materials. In the Southwest the use is termed small. The Far West divides north and south. Southern California makes large use of plastic fabrics; the Northwest has yet to accept these materials in volume.

FINANCIAL NEWS

SALES OF $1,029,402,035 SET NEW FIRESTONE RECORD

Firestone Tire & Rubber Co. sales moved up past $1,000,000,000 for the fiscal year ended October 31, 1953, to a new company record, while earnings were a shade less than the 1951 peak, Harvey S. Firestone, Jr., chairman, announced recently.

Net income of the tire company amounted to $46,748,971 or $11.77 a share, compared with $43,081,717 or $10.89 a share, in the preceding year. In 1951, the company reported net income of $48,398,950 which was equal to $12.27 per share of common stock. Last year's earning gain was made despite a large increase in income and excess profits taxes to $47,400,000 for the 1953 fiscal year from $40,900,000 in 1952. Sales of the company totaled $1,029,402,035 in the year to October 31 compared with $965,364,427 a year earlier, Mr. Firestone reported.

Net income of the foreign subsidiaries of Firestone was $13,253,181 which was lower than in the preceding year due mainly to the reduced value of Brazilian currency which followed establishment of a free-rate exchange market. The resumption of dividend remittances from Brazil made unnecessary any provision for unremitted income due to exchange shortages, Mr. Firestone said. Devaluation of assets located in Brazil resulted in a charge of $16,550,180 to a reserve provided from income in prior years, he explained.

Plant and equipment expenditures during 1953 totaled $43,679,581 which was about the same as in the preceding year, he disclosed. In 1952, capital spending amounted to $42,952,000. Last year, depreciation charges provided $24,700,000 of the expenditures while the remainder came from retained earnings. In the 1952 fiscal year, depreciation was $20,700,000.

Anaconda Wire & Cable Co.

Nine Months to September 30: Net income of $4,992,825, which is equal to $5.92 a share, compared with $4,715,659, or $5.59 a share, in the first nine months of the preceding year.

United Carbon Co.

Nine Months to September 30: Net income of $2,860,114, which is equal to $3.59 a share, compared with $2,582,971, or $3.25 a share, in the first nine months of 1952.

Announces Nygen Cord Tires

General Tire & Rubber Co. has announced production of the first passenger car tires in America built with Nygen, the special cord converted from nylon fabric. Now on the market under the name, "Nygen Super Squeegee," the tires have proven to be the strongest casings ever developed by the company. General Tire is now producing both passenger and truck tires using Nygen. It is stated that pound for pound, Nygen stacks up stronger than steel cables.

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CANADIAN NEWS

Effective January 1, 1954, Union Carbide Canada, Ltd., a subsidiary of Union Carbide & Carbon Corp., will operate the business of all of the following companies: Bakelite Co. (Canada), Ltd.; Canadian Railroad Service Co., Ltd.; Carbide & Carbon Chemicals, Ltd.; Dominion Oxygen Co., Ltd.; Electro Metallurgical Co. of Canada, Ltd.; and National Carbon, Ltd.

These companies are units of Union Carbide & Carbon Corp. In the future their respective businesses will be carried on by divisions of Union Carbide Canada, Ltd., under the following division names: Bakelite Co., Canadian Railroad Service Co., Carbide Chemicals Sales Co., Dominion Oxygen Co., Electro Metallurgical Co., and National Carbon Co.

Ewart Greig, formerly vice-president of National Carbon, Ltd., is the president and director of Union Carbide Canada, Ltd. Other directors are: Honorable Salter A. Hayden, Q.C., of McCarthy and McCarthy; and H. S. Bunn, S. B. Kirk, and W. E. Remmers, vice-presidents, and K. H. Hannan, secretary and treasurer of Union Carbide & Carbon Corp.

B. F. Godrich Rubber Co. of Canada, has announced that it is transferring its footwear manufacturing operations in Kitchener, Ont., to the Province of Quebec, beginning in January. More than 400 employees will be affected. Ira G. Needles, president, said a working agreement has been reached with a Quebec manufacturer for the production of Goodrich brand footwear, using Goodrich designs, specifications and technical knowledge. Name and location of the manufacturer was not announced, but it is believed that the Miner Rubber Co. of Granby, Que., is the company in question.

Mr. Needles said high production costs, of which labor was a principal factor, had placed the company in a non-competitive cost position as compared to other footwear manufacturers, adding that the average wage of Goodrich footwear workers was substantially higher than the average Canadian wage for such work.

Dow Corning Corp., Midland, Mich., under its new Canadian subsidiary, Dow Corning Silicones, Ltd., has commenced the construction of a Canadian plant, warehouse and offices on a four-acre site, fronting on Tippet Road, Toronto. The company produces organo silicone products for both industrial and domestic applications. Expenditures for the project will total about $400,000. The company's industrial products will include silicone fluids for polishing, textile finishes, bonding resins, electrical insulating resins and varnishes and the Dow Corning silicone rubber.

L. Albert & Sons, Akron, Ohio, is setting up a manufacturing plant at Brantford, Ont. W. K. Warrender, Ontario Minister of Planning and Development, said initially the Brantford facilities will occupy 10,000 square feet and involve an investment of $40,000, but that it is planned this operation will be more than doubled during the first year. L. Albert & Sons have sold in Canada for 35 years.

Canada Wire & Cable Co., Ltd., Toronto, Ont., has purchased a new plant in Smith's Falls, Ont., and will transfer equipment to the new unit from its Leaside, Ont., plant. The program will cost around $750,000.

Dow Chemical Co. of Canada has put its new synthetic latex plant at Sarnia, Ont., into operation, some six weeks before it was expected to go into production.

George F. Plummer, secretary-treasurer of the Dunlop Tire & Rubber Goods Co., Ltd., has been appointed chairman of the Canadian Affairs Committee of the Controllers Institute of America. Established in 1931, the Institute is a non-profit organization of controllers and finance officers from all lines of business. The total membership exceeds 4,200.

Promotes Hanchett and Shand

Donald J. Hanchett and Dr. Edwin W. Shand have been appointed to new posts in the sales development section of the Chemical Division of the Koppers Co., Pittsburgh, Penna. Mr. Hanchett, who has been adhesives product manager in the division's sales department since 1951, has been named manager of the thermosetting resins branch of the sales development section. In addition to retaining his former responsibilities for merchandising and marketing of Penacolite low-temperature setting resorcinol formaldehyde adhesives, Mr. Hanchett also will supervise sales development of resorcinol for tire cord adhesives and chemicals used in the tanning, water-proofing and finishing of leather. Dr. Shand, who has been a technical representative of the division's sales department since 1948, has been appointed manager of the specialty chemicals branch of the sales development section. He will be responsible for marketing, sales development and technical service activities concerning Koppers organic and inorganic chemicals produced at plants in Petrolia, Penna., and Kearny, N. J.

Brazil Plans Synthetic Industry

According to a recent announcement, the first steps toward the installation of a synthetic rubber industry in Brazil have now been taken. The Institute of Sugar and Alcohol has approached French technical consultants, whose studies are expected to begin shortly. The Institute's plan calls for the installation of synthetic rubber factories in the alcohol-producing centers of Pernambuco, the State of Rio and Sao Paulo.

Goodrich Chemical Promotes Wolf

Dr. Robert J. Wolf has been appointed director of development at the Avon Lake, Ohio, experimental station of the B. F. Goodrich Chemical Co. Dr. Wolf received his doctorate in chemical engineering from the Case Institute of Technology in 1942 and taught at Princeton University prior to serving three and one-half years with the U. S. Navy. He joined Goodrich Chemical in 1946 and served in various positions until his appointment as manager of the sales development laboratory in 1952. He will now supervise all technical activities at the Avon Lake station. Dr. Wolf is a member of the American Chemical Society, American Institute of Chemical Engineers, and the Armed Forces Chemical Association.

In other appointments, Claude H. Alexander was named coordinator of technical service, while Dr. Benjamin M. G. Zwicker was appointed coordinator of product development. Mr. Alexander joined the company as a chemist in 1930. He filled several technical positions until 1943 when he was promoted to technical manager of product development. In 1946, he was transferred to the Cleveland office as a staff representative of the vice-president, technical, a post he held until his most recent appointment.

Dr. Zwicker came to Goodrich in 1940 as a research chemist. He became technical manager in charge of development at the Akron experimental station in 1943, and was made manager of that station in 1948. Since 1950, Dr. Zwicker has been technical analyst for development programs of the B. F. Goodrich Chemical Co.

Firestone Promotes Borda

Paul Borda, for the past two years general manager of the Ravenna Arsenal, Inc., operated by the Firestone Tire & Rubber Co., has been named general factory manager of the company's plant in Memphis, Tenn. Mr. Borda succeeds Joseph A. Meek, who has been named director of industrial relations for the company. Mr. Borda joined the Firestone organization in Akron in 1920 as a dispatcher in the Maintenance Department. In 1925, he became foreman of the Final Inspection Department, and in 1928 was named department manager of final inspection. In 1938, Mr. Borda became production superintendent of Plant 2 in Akron. From 1942 to 1945, he was assigned to the Nebraska Ordnance Plant and became its general manager in 1944.

Feely Leaves Ohio Rubber

Charles L. Feely, purchasing agent of The Ohio Rubber Co., Division of Eagle Picher Co., Willoughby, Ohio, has resigned effective January 1st, to become vice-president in charge of manufacturing and sales of the West Brick Buggy Corp., Cleveland, Ohio. The West Brick Buggy Corp. will manufacture and distribute hydraulic lift trucks and front end loaders especially designed and built for use in handling brick, concrete blocks, and similar materials in the construction industry.

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OBITUARIES

Harry J. Smith

Harry James Smith, owner and operator of the Continental Machinery Co. of New York City for the past 20 years, died in New York at the age of 72 on December 14 as the result of cancer of the bladder. He had been suffering with the disease for many years and underwent a major operation in 1949. Despite the handicap, he was active in the field until his death.

Mr. Smith was born in New York City on March 6, 1881. After attending public school he worked at varied and sundry jobs for a few years, and while still in his teens he went out to Akron where he took a job with the Goodyear Tire & Rubber Co. as a factory worker in one of the tire units. He worked himself up to superintendent of the tire plant before leaving the company in 1914.

Shortly after leaving Goodyear, Mr. Smith supervised the construction of a tire plant for the former Ten Brook Tire Co. in Louisville, Kentucky, and two years later, in 1916, aided in the building of a similar plant for the former Newcastle Tire & Rubber Co. in Newcastle, Penna. In both cases he acted as factory manager for a short time. In 1917 he went to Spain to supervise the construction of a mechanical goods plant for a company which was later absorbed by the Pirelli organization.

Returning to the United States in 1919, Mr. Smith organized his own rubber company, the Achilles Rubber & Tire Co., in Binghamton, N. Y. He retained ownership of this company until it was liquidated in 1933. In 1924 he joined the National Rubber Machinery Co., of Akron, as a foreign sales representative and for the next nine years traveled extensively throughout the world in that capacity.

In 1933 Mr. Smith organized the Continental Machinery Co. to specialize in the design and manufacture of rubber plant equipment of all kinds. He installed rubber factories in Finland, Italy, Ecuador, Belgium, Sweden, Brazil, and many other countries. He was given a special citation by the Ecuadorean Government in 1943 and was made a member of the Order of the White Rose and the Order of the Lion by Finland in 1947. He also received a special citation from the Brazilian Government. The Finnish honors were bestowed not only in appreciation of his work in the rubber field but because of his humanitarian efforts in aiding Finland during and after the wartime period. At one time Mr. Smith sent a full carload of food, clothing and other necessities to the Finnish people.

Mr. Smith was a high degree Mason, holding 3rd degree, Shriner and Knight Templar positions. He was an enthusiastic supporter of the Northern Dispensary of New York, serving as president at one time and being a trustee at the time of his death. He was a bachelor and the last member of his branch of the Smith family. He was buried in the family plot in Ohio.

Ames B. Hettrick

Ames Bartlett Hettrick, an executive of American Cyanamid Co. with which he had been associated for nine years, died recently. He was 49 years old. Educated at Massachusetts Institute of Technology in engineering administration, Mr. Hettrick had been closely identified with the development of the commercially important titanium dioxide pigments. He joined the Stone and Webster Engineering Corp. in 1928 and in 1931, Southern Mineral Products Corp. as chief engineer, becoming plant manager in 1934. When this company was purchased by Virginia Chemical Corp. in 1936, he became vice-president and general manager of the new organization. Upon the acquisition of Virginia Chemical's titanium interests by Calco Chemical Division of American Cyanamid Co. in 1944, he became works manager of the Piney River, Va., plant operation. In 1946, Mr. Hettrick was made assistant manager of manufacturing for the Calco Chemical Division. Mr. Hettrick was born in Clinton, Iowa, and received his early education in East Bridgewater, Mass. He was an active member of the American Society of Mechanical Engineers, American Institute of Chemical Engineers. Surviving are his wife and three sons.

Harry I. Kleinert

Harry I. Kleinert, a director and former president of the I. B. Kleinert Rubber Co., and manager of its factory for 52 years, died on December 18 at Lenox Hill Hospital, New York, N. Y. He was 79 years old. Mr. Kleinert was born at Monmouth, Ill., and was a nephew of I. B. Kleinert, the company's founder. He started working for the organization in 1889. As manager and later president of the company, he played a large part in the firm's growth. On the anniversary of his fiftieth year with the company in 1944, he was guest of honor at a special dinner at which time he was presented with a diamond studded service pin. Mr. Kleinert was one of the founders of the College Point National Bank at College Point, L. I., N. Y., of which he was first president. He had been a Mason for more than half a century. He leaves his wife and son.

Palmer J. Lathrop

Palmer J. Lathrop, president of the Cameron Machine Co. of Brooklyn, N. Y., drowned on December 26 while attempting to rescue his dog which had fallen through the ice on a reservoir near Millburn, N. J. Mr. Lathrop was 44 years old. He was graduated from Princeton University in 1931, and was a glider pilot in World War II. Mr. Lathrop was vice-president in charge of production at the Bristol-Myers Co. before joining Cameron Machine in 1948. He leaves his wife and son.

Earl F. Jackson

Earl F. Jackson, first Detroit district and division manager and a pioneer in original equipment sales for Goodyear Tire & Rubber Co. died recently at Detroit, Mich. He was 77 years old. One of America's best bicycle racers in his youth, Mr. Jackson was hired by Goodyear to head its Detroit operations in 1907 because of his wide acquaintance with bicycle and carriage makers that were changing over to automobiles. Stationed at Detroit during his entire Goodyear service, Mr. Jackson witnessed the complete development of the automobile. From the early days of the automotive industry, he saw the rise of the great automobile companies and knew all the important leaders. Until his retirement in 1937 he devoted most of his time to manufacturers sales. His pioneering in this field paved the way for the entire pattern of present day manufacturers sales by Goodyear. Mr. Jackson was a manufacturers agent at Detroit for several years after leaving Goodyear and for the past 10 years has been in complete retirement. He is survived by his wife.

Francis J. Collins

Francis Joseph Collins, a sales and service engineer for the Farrel-Birmingham Co., died on December 7 at St. Thomas Hospital, Cuyahoga Falls, Ohio, after a six-week illness. He was 45 years old. Mr. Collins, a native of Richfield, Conn., had been associated with Farrel-Birmingham for 25 years. For the past 9 years he had been representing the firm in the Cuyahoga Falls area. He is survived by his wife and two sons.

Lower Grade Sheets as Wrappers

The Rubber Manufacturers Association advises that a new problem which has concerned inspectors over the past several months involves the use of lower grade sheets as wrappers on incoming bales of No. 3 Ribbed Smoked Sheets. Under the RMA contract, use of such wrapper sheets makes the rubber a non-bonafide tender. At a recent meeting of the RMA Crude Rubber Committee, F. D. Harrison, manager of the Goodyear Orient Co. in Singapore, offered an explanation of this practice. Mr. Harrison said that in upgrading a No. 4 sheet to a No. 3 sheet, a packer has to clip the sheet to remove bark or other foreign matter. Steamship lines in the Far East will not permit the use of clipped sheets as wrappers because of the increased possibility of bale contamination in transit. Mr. Harrison said few packers are aware of the fact that the use of unclipped sheets of a lower grade makes the rubber a non-bonafide tender under the RMA contract or renders it subject to substantial allowance if accepted by the consignee. The RMA packing specifications provide "double wrapper sheets must be used if wrapper sheets contain holes." Since the problem has arisen in shipments of Siamese rubber, the chairman of the Crude Rubber Committee has written to the Rubber Association in Siam seeking its help in correcting the problem.

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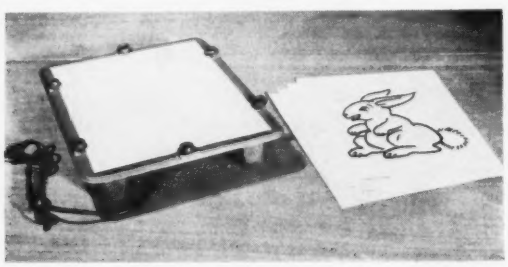
NEW GOODS

Frestep Aisle Runner

The addition of a new line of low-cost, plastic-surfaced sponge rubber aisle runners to the complete line of rubber and plastic flooring manufactured by the Fremont Rubber Co., Fremont, Ohio, recently was announced. "Frestep", as the new runner is called, is manufactured in 36-inch widths and 25-yard long rolls. The new resilient material will find innumerable uses in professional offices, industrial plants, institutions and mercantile establishments. Its ease of cleaning and added comfort are especially desirable features where traffic flow is heaviest in all types of buildings, the company states. The new vinyl plastic covering of the Frestep aisle runner line is an improved, long-wearing type to give years of service wherever safe traffic lanes and noiseless walking are required. Four marbleized colors are available: dark green, brown, red and gray.

Cortland Tra-Se-Lite

Cortland Industries, Chicago, Ill., is now producing "Tra-Se-Lite", a new educational toy designed to help a child's creative faculties in drawing, and which does double-duty as a nightlight. Tra-Se-Lite is formed in one piece from lightweight, impact-resistant "Campco" sheet, a new type of extruded sheeting made of poly-



styrene and rubber alloy. Special clips, which open with a twist, permit easy replacement of drawings. At night, with a drawing snapped into place, the whole shadow box can be hung on the wall and used as a nightlight. Light is supplied by a standard 110-115 volt Christmas tree lamp. The toy comes in a bright red color and is distributed by the Illuminated Plastics Co. of New Holstein, Wisc.

Sponge Rubber Ankle "Collars"

Ralph K. Nourse, who runs the K-9 Plastics Co. in Akron, Ohio, has developed and is marketing a sponge rubber cylinder designed to be worn around the ankles to pad out socks worn by school girls. At one time the fad was for a young lady to wear a dog collar as an ankle decoration. Now the mid-west school girl has taken to padding out her ankle socks, giving a "collar" effect around that portion of the leg. Girls had been padding their socks with handkerchiefs, cotton, etc., and so the sponge rubber "collar" was a natural development, Mr. Nourse stated.

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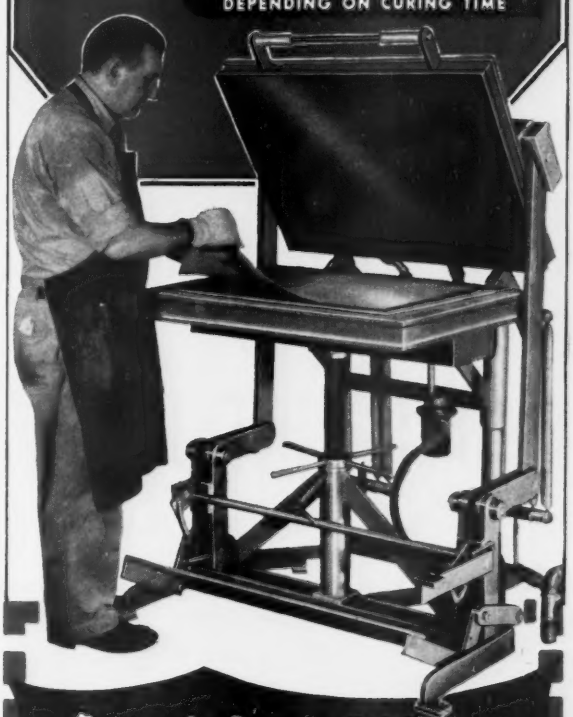

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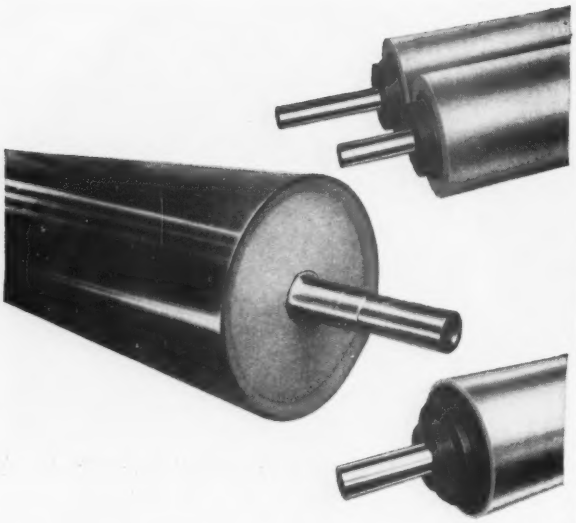

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Other applications include such consumer products as the home washing machine. It takes a force of more than 1400 pounds to move a 2000 pound machine mounted on these pads. The pads consist of layers of cork, and sisal fiber, impregnated with Bakelite vinyl resin. These anti-vibrational pads were installed under a 3000-pound cotton loom for little more than $9.00 counting labor and material cost, and loss in production time. Mounting felt pads under the same machine would cost approximately $34.00. Pads are supplied in standard, pre-cut sizes, up to 32 inches square, that cut to fit most industrial equipment.

Vinyl Shower Curtains

Announcement of the latest development in vinyl shower curtains, a new spring line made from heavy, eight-gauge, specially compounded, soap-resistant vinyl film now being made by the Goodyear Tire & Rubber Co., has been made by the Hygiene Shower Curtain Manufacturing Co. of New York, N. Y. Hygiene company officials stated that the new eight-gauge curtain is the first of its thickness on the market. The company will market the new boilable, soap-resistant material for spring in three basic patterns, each in eight different color schemes. Matching bathroom window curtains of the same vinyl film will be available in the eight-gauge material, either dainty, ruffled tie-back models or the classic tailored type. All of the plastic curtains manufactured by the Hygiene company are of Goodyear "Vinylfilm" in four-gauge, six-gauge and the new eight-gauge. The line includes some 80 different patterns, 24 of which will make their debut this spring.

Rigid Vinyl Swimming Pools

Blazon, Inc., First National Tower, Akron, Ohio, has introduced its new line of rigid vinyl pools. The pool has a "no seam" vinyl construction which is said to give added strength. The entire frame is one inch steel tubing, painted inside and out for rust resistance. Saddle seats anchor the corners firmly, and the reinforced, tapered legs brace the corners and give solid ground support. The vinyl itself is 20-gauge, and is all-white silkscreened with vinyl paints in four colors. The pool has a giant drain and may be cleaned in seconds with a hose. It comes complete with a repair kit in case of unusual damage.

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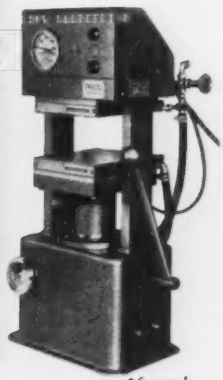

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R/M Super-Power V-Belt

The Manhattan Rubber Division of Raybestos-Manhattan, Inc., has introduced an improved "super-power" V-belt which, the company says, has a horsepower capacity average of 40% over standard V-belts. The company states that in addition to providing 40% greater horsepower capacity on existing drives, the belt, known as the "R/M Super-Power V-Belt", lasts relatively longer than standard V-belts. On new drives, narrower sheaves may be used, saving space, because fewer belts are required for the same power demands. The new belt also has practically no stretch, virtually eliminating belt matching problems.

Tests in which this belt was run against standard makes, the company says, show it gives longer service where existing standard V-belt drives are underbelted or unsatisfactory, withstanding shock with greater elastic resistance, and requiring less take-up maintenance and fewer V-belt replacements. The belt has the same advantages of smooth running performance claimed for the firm's Condor V-Belt, but its design incorporates a new super-strength synthetic fiber strength member for greater power. The new belt's construction is of all synthetic rubber, and is also oil-proof, non-spark and heat-resistant.

Phenolic Resin Microballoons

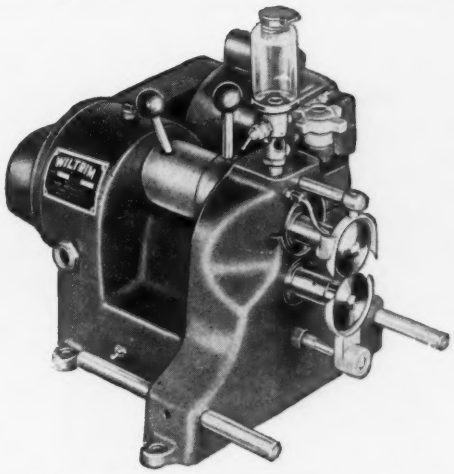
Microscopic balloons made of Bakelite phenolic resin as developed by the Standard Oil Co. of Ohio are being used to form a floating roof on the oil in storage tanks. A reduction of 80 to 90% in evaporation loss, which normally claims four out of every hundred barrels of the nation's crude oil in storage, is reported. Ranging from .0002 to .0036 inches in diameter, the balloons, called "Microballoons", resemble brown ping-pong balls. They are filled with inert hydrogen gas sealed in by thin walls of Bakelite phenolic resin, and have a bulk density of about 8.7 pounds per cubic foot. In experimental laboratories, Microballoons have floated on the surface of crude oil for more than two years without any measurable sign of deterioration. Their strength and resistance to abrasion keeps the balloons from bursting as they jostle together and against tank walls. Large-scale production and marketing of the tiny plastic balloons has been announced by the Bakelite Co., New York, N. Y.

Round Rubber Bands

Round rubber bands, which retain their shape when packaged, have been announced by the B. F. Goodrich Co., Akron, Ohio. The round bands are said to be easier to pick up and sort and thereby speed up operations. Users who have tested the new bands report they require less handling and therefore help reduce costs. Newspapers, banks, insurance companies, vegetable growers, and other major users will find the round rubber bands can easily be picked up with one hand for application. Other types normally have to be handled with both hands. The round bands lend themselves to sorting by finger so that they can quickly be bunched together. Goodrich is now manufacturing round gray bands in sizes 10, 12, 14 and 16. They will sell at the same price as those bands of standard shapes.

WILTRIM®

Model DF
TRIMMER



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RESORCINOL is used for both the preparation of adhesives that assure strong bonds between rubber or synthetic rubber and nylon, rayon and cotton tire cords and the manufacture of conveyor belts, hose, etc.

DI-tert-BUTYL-para-CRESOL has application as an antioxidant in white rubber products. It retards cracking, hardening and loss of strength without discoloring the product or staining materials with which the product comes in contact.

DIVINYLBENZENE (20-25% and 50-60% grades) in synthetic rubber manufacture improves processing and decreases shrinkage of the product. With styrene and other monomers, it produces insoluble and infusible copolymers.

MONO-tert-BUTYL-meta-CRESOL is used in the manufacture of an effective anti-flex cracking agent for rubber and rubber-like materials. The resin obtained by condensation of MBMC with formaldehyde imparts tack to GR-S rubber. For detailed information on any of these products, please write to:

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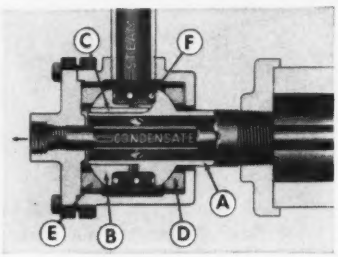
NEW EQUIPMENT

Series 2000 Type J Johnson Joint

Less weight, smaller size and longer life for the wearing parts are said to be some of the advantages offered by the Johnson Corp., 868 Wood St., Three Rivers, Mich., in their new Series 2000 Type J Johnson Joint. These joints are designed for admitting steam or fluids into the rotating rolls and cylinders of rubber, paper and



similar machines, and are available in the through flow type—which calls for location of a joint at each end of the roll—or syphon pipe type, which has both the inlet and outlet connections housed in the same joint. The special carbon graphite, self-lubricating seal rings have been increased in thickness at the web to provide an average of 25% longer life, the company states. As before, the new joint is completely packless and self-adjusting.

In the accompanying drawing, the arrows show how steam enters the Type J Johnson Joint through an inlet in the body, passes through ports into the nipple and then into the roll or cylinder. Condensate is removed through the head. The rotating member consists primarily of just two parts—the nipple (A) and the thrust collar (B) which slides freely endwise over the nipple but is keyed to it at (C). Both of these parts have convex hemispherical surfaces as shown, which rotate against the matching concave surfaces of two special carbon graphite rings (D) and (E). The spring (F) maintains an initial seating pressure against these two rings, but the actual sealing force is the pressure within the joint, which forces the seal ring (D) against the nipple; the higher the pressure, the tighter the seal. The ring (E) serves as a bearing for the thrust collar.

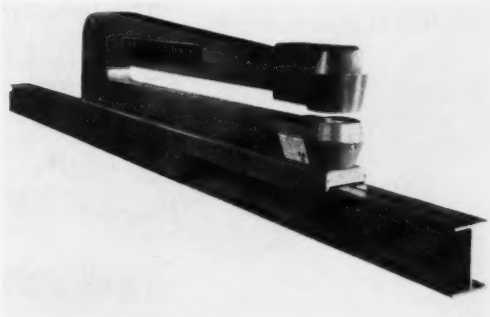
New AccuRay Gauge Mounting

A new basic mounting design for AccuRay radiation gauges has been announced by the Industrial Nucleonics Corp., 1205 Chesapeake Ave., Columbus 12, Ohio. Featuring a streamlined measuring head and a tapered bracket, the new unit permits a standardization of measuring systems throughout the complete line of AccuRay mountings. According to company officials, the low, compact measuring head simplifies installation on production lines and provides easy access for servicing. The tapered bracket, available in throat depths up to 160 inches, is said to be extremely strong and resistant to vibration and shock.

Widely used to measure and control continuous sheet

production in the rubber, plastics, paper, and sheet-coating industries, the AccuRay utilizes radiation to give a direct reading of weight or thickness without contacting the sheet.

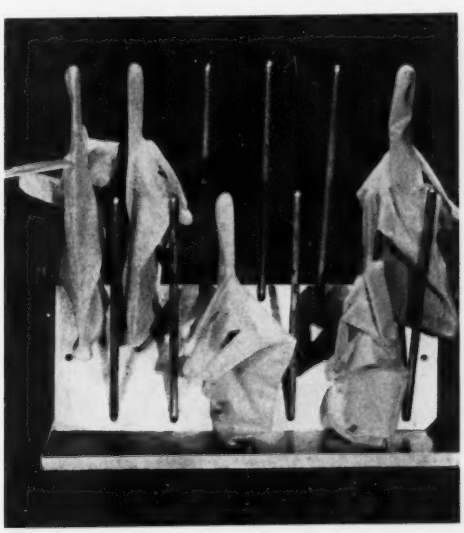
Of special interest to industries where sheet profile control is important is the new variable-speed scanning



mechanism also announced by Industrial Nucleonics. This unit enables the gauge to move slowly across sheet —while presenting a continuous profile picture — and then retract quickly to repeat the scanning cycle. When the gauge withdraws, the recorder pen remains stationary to mark the beginning and end of each profile reading.

General Scientific Glove Dryer

Made of aluminum throughout, the new glove dryer marketed by the General Scientific Equipment Co., 2700 W. Huntingdon St., Philadelphia 32, Penna., is provided with a drip pan and a draining faucet. The unit is com-



pletely mounted on a sturdy wooden base in mahogany finish for easy attaching to a wall. Two models are available, Model No. 38 with 12 prongs to dry 6 pairs of gloves, and Model 40 with 24 prongs to dry 12 pairs of gloves.

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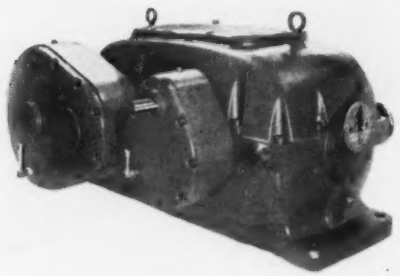
Link-Belt P.I.V. Speed Drives

Link-Belt Co., 307 N. Michigan Ave., Chicago 1, Ill., has announced the availability of positive, infinitely variable speed drives in two types for 20 to 25 hp applications. In addition to the basic H-6 P.I.V. of 25 hp capacity, the company can now supply an HG-6 drive, furnished with either a single reduction input or single



reduction output helical gear attachment, or an HGG-6 drive, shown herewith, furnished with both a single reduction input and single reduction output helical gear attachment. Input gear reductions are available from 1.93:1 minimum to 5.82:1 maximum, and output gear reductions from 1:1 to 6.33:1. Speed increasing gear sets are also available.

The complete Link-Belt line includes P.I.V. drives in eight sizes, ranging from ½ to 25 hp capacity, with ratios up to 6:1, in 16 types, for horizontal and vertical mounting, with and without helical gears and integrally mounted motor. The P.I.V. variable speed drive provides accurate speed control, adjustable over a wide range of speeds. It transmits power positively, without slip, by means of a drive chain with self-forming metal teeth that engage with radial grooves in two pairs of cone-shaped wheels. Ratio is changed by altering the effective diameter of the wheels. The drive is fully enclosed and constructed entirely of metal. All moving parts are splash lubricated from a common reservoir. The drive is unaffected by high or low temperatures, humidity, abrasive dust or explosive vapor conditions.

Reliance Squirrel-Cage Induction Motors

A new line of well protected, versatile squirrel-cage induction motors was recently announced by the Reliance Electric & Engineering Co., 1088 Ivanhoe Road, Cleveland 10, Ohio. The line, including protected and enclosed motors for all industrial purposes, is being built to recently adopted N.E.M.A. standards. The first of the new Reliance motors to appear will be built for 1, 1½ and 2 h.p. applications, in frame sizes 182 and 184. The balance of the line, up to and including 30 h.p., will be introduced at regular intervals during 1954 and the early part of 1955. The present Reliance a-c line will continue to be available during this change-over period to fill the needs of those users who wish to complete current projects with motors as they are now being made. The new motors will include many new features. For example, open motors, as they were known in previous designs, will give way to highly protected machines; the new totally-enclosed fan-cooled motors are built to operate under a wide variety of adverse atmospheric conditions and in any mounting position.

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There are many reasons why so many prominent rubber manufacturers continue to use RUBBER-FLO year after year. Primarily it's because RUBBER-FLO is low in cost, odorless, non-toxic, uniform in quality and keeps molds clean for so long. Test RUBBER-FLO yourself and see !

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Ohopex R-9 is a new plasticizer developed particularly for permanent low temperature flexibility with chloroprene base synthetic rubbers. When aged 7 days @ 121°C. (A. S. T. M D412-D865) cured stocks containing **Ohopex R-9** lose none of their low temperature flexibility.

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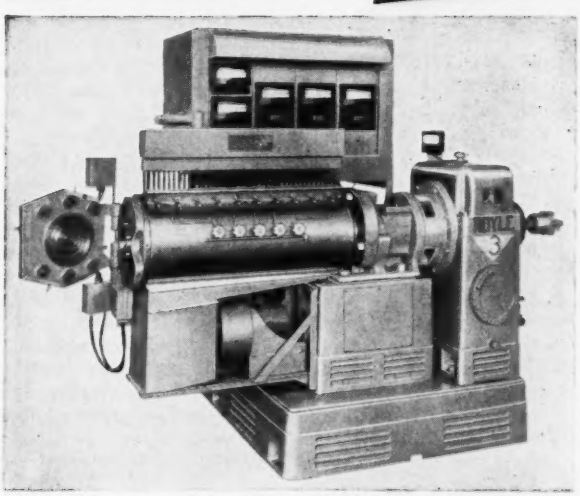

Here are some of the time-tested, money-saving reasons more and more plants are standardizing with Royle Spirod* Extruders for processes requiring maximum flexibility in controlled temperatures — constantly maintained and accurately zoned:

- **Extra heavy walled cast steel cylinders that will not warp. No joints to leak when pressures are high or crevices to collect burned compound that would cause contamination.**
- **Heavy duty large diameter heating elements, that can be used with 440 volts without step-down transformers, provide radiant heat to cylinders and heads.**
- **Any heating element may be removed and replaced without disturbing other elements or wiring.**
- **A cooling system with ten times the capacity of conventional designs can be modulated through its entire temperature range without drastic changes. Ample cooling for all compounds at maximum speeds.**

No. 3 Royle Spirod Extruder. Completely insulated and equipped for evaporative cooling.

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A constant volume of air at a controlled temperature in the heavily insulated cabinet, maintains uniform predetermined specimen temperatures regardless of variations in room conditions.

Automatic control of humidities up to dew point is available as optional equipment.

All automatic controls including complete voltage controls are located on the front panel of the Weather-Ometer directly above the door of the test chamber.

Both horizontal and vertical testing is available. Shallow containers are used for semi-liquid materials and vertical panels for solid materials.

Source of radiation is two Atlas enclosed violet carbon arcs.

Complete technical information on the DMC model and other Weather-Ometers is contained in the new Weather-Ometer catalog. A copy will be mailed on request.

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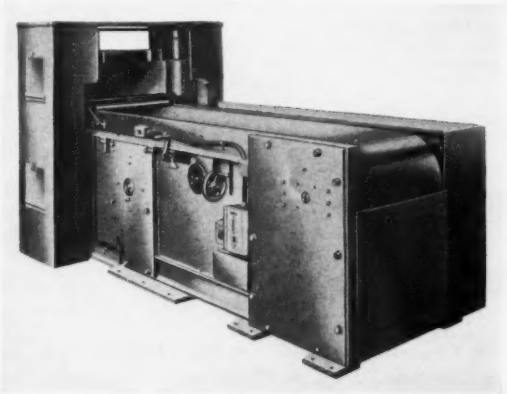
Manufacturers of accelerated testing equipment for over a quarter of a century.

Powermax Guillotine Rubber Cutter

Guillotine cutter machines are used for cutting either cured or uncured rubber or like materials to specific lengths. Clicking machines are used to cut the same materials to shape by means of a clicker type die. These dies can either be of all steel or steel rule type. Powermax cutters, made by the Akron Standard Mold Co., Akron 5, Ohio, perform speedy automatic cutting to very close tolerances with either manual loading or directly coupled to calender, mill, or tubing machines. They



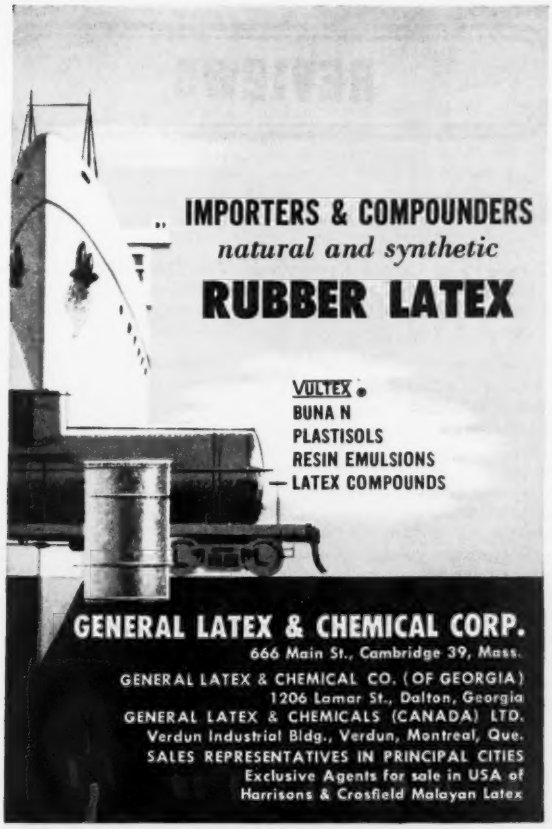
are made for continuous heavy-duty service and are the product of many years of experience and research in building this type of machine.

Length and accuracy of material cut is maintained by a special endless conveyor belt driven by a rotating drum, the motion of which is accomplished by a special Warner electric brake and clutch unit made up as an integral part of the drum. The electric brake and clutch driving the drum is actuated by a mechanism having a rotating adjustable arm which can be adjusted while in motion.

The feed mechanism gradually accelerates and then decelerates for each feed stroke, letting the conveyor belt start out slow, reducing slippage under the rubber, and gradually slows down at the end of the feed stroke, reducing over-ride of the conveyor. Over-running of the belt and drum at high speeds is prevented by the electric clutch which does not release the drum until the end of the indexing stroke. All forward motion of the belt at the end of the indexing stroke is prevented by the electric brake which holds the belt and drum stationary until the clutch again starts the indexing cycle.

Controls for speed and length of cut are located on the left side of the machine just back of the cutter head unless otherwise specified. Both speed and length of cut can be adjusted while the machine is running. The unit is equipped with an overhead driven roll preventing slippage on the conveyor belt of rubber or other material being cut. This roll can be raised up out of the way when not needed. It is a corrugated steel roll unless otherwise specified. Maximum thickness of cut is 3 inches on the standard machine, maximum speed is 90 cuts per minute, and cutting lengths can be varied from 0 to 30 inches.

A radically new, adjustable and extremely precise low pressure **relief type valve** is now being produced by James-Pond-Clark of Pasadena, Calif. It is designed for controlling gases safe to release into the atmosphere.



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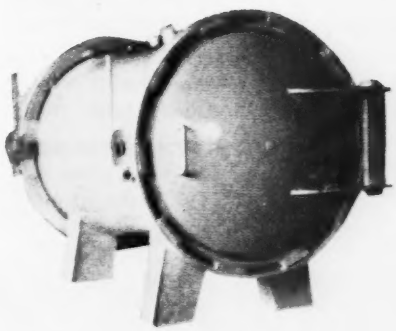

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REVIEWS

BOOKS

Chemistry of Carbon Compounds. Vol. II-A. Alicyclic Compounds. Edited by E. H. Rodd. Published by Elsevier Publishing Co., 402 Lovett Blvd., Houston, Texas. 6 x 9 in. 488 pp. $12.50. (Printed in The Netherlands).

The series of volumes being issued under the name of "Chemistry of Carbon Compounds" is intended as a successor to Richter's "Organic Chemistry" and the work is being designed to fill the general needs of all practicing organic chemists whatever their sphere of operation. The volumes are prepared by teams of distinguished chemists of international renown. The first volume contained a general introduction to the full series and covered aliphatic compounds. Five volumes are planned in all, and the last volume will contain a general index to the full series.

The present volume, as indicated by its title, presents the chemistry of the non-aromatic carbocyclic compounds. The first chapter discusses the theoretical aspects of the structure and stability of saturated carbon rings and the following chapters are devoted to the chemistry of the different types of alicyclic compounds, from those containing single rings of all sizes to the more complex spiro, fused ring and bridged ring compounds. Among the groups covered are the cyclopropane, cyclobutane, cyclopentane, cyclohexane, cycloheptane, cyclo-octane and macrocyclic. Polynuclear alicyclic compounds and open-chain and cyclic polymers derived from olefinic compounds are also discussed.

Data on natural high molecular weight isoprene polymers, including natural rubber and its derivatives and polyisoprenes of gutta-percha, balata and the like, is furnished in Chapter 9, as is information on synthetic elastomers. The latter covers history, techniques used in preparing elastomers from dienes, structure of elastomers from dienes, and elastomers not based on dienes, such as the polyesters, polysulfides, polyvinyl chloride, polyacrylates and the silicones.

•

Silicones and Their Uses. By Rob Roy McGregor. Published by McGraw-Hill Book Co., Inc., 330 West 42nd St., New York 36, N. Y. 5½ x 8 in. 302 pp. $6.00.

The available information on the numerous types of silicone products is ably correlated in this work. The properties, preparation and applications of these fascinating materials are described in non-technical language to give the reader an over-all picture of what silicones are and what they can be used for. Types of commercial products covered include silicone rubber, silicone fluids, silicone compounds, silicone lubricants, silicone resins, and "bouncing putty." Representative industries and the uses they are making of silicones are tabulated and techniques of application shown. Preparation of silicones from raw material to the finished product is explained in an elementary manner to make this information equally helpful to both chemists and non-chemists. The section on silicone rubber covers 36 pages and treats with chemical and physical properties, preparation of the rubber, types available, and numerous commercial applications in the form of dispersions, pastes, and stocks. The book has 5 chapters and a subject index. A list of 152 literature references is also included.

•

World Production of Raw Materials. Published by the Royal Institute of International Affairs, 452 Fifth Ave., New York 36, N. Y. 5½ x 8½ in. 104 pp. $1.50. (Printed in Great Britain).

This is a revised edition of the work issued under similar title in 1941. It is divided into three sections, the first being a survey of raw materials throughout the world, the second containing notes on sources and uses of the materials, and the third containing tables of world production. The raw materials covered in the booklet include fibers (cotton, wool, silk, rayon, flax, jute, etc.),

other agricultural products (rubber, timber, wood pulp, tobacco, etc.), metals (iron and steel, steel-alloying elements, non-ferrous metals), non-metallic minerals (coal, petroleum, natural gas, sulfur, mica, etc.), and synthetic materials (plastics, synthetic rubber, artificial fibers, dyestuffs, etc.). The survey section gives data on categories of raw materials, trends in production since 1945, geographical distribution, and current developments in output. The booklet is a handy reference manual of statistics.

•

The Van Nostrand Chemist Dictionary. Published by the D. Van Nostrand Co., Inc., 250 Fourth Ave., New York 3, N. Y. 6 x 9 in. 762 pp. $10.00.

This is a new type of chemical dictionary which has been designed to meet the needs of the present-day chemist and chemical engineer. It contains over 11,000 definitions of laws, equations, reactions, tests, solutions, laboratory apparatus, and industrial processes and equipment. Both proper name terms and common names are included so that, for example, the user can locate the law of the rectilinear diameter as well as the law of Gay-Lussac or the Langmuir adsorption isotherm as well as the equation of continuity. The definitions in the book, prepared by a special board of editors, are specifically shaped for the use of the chemist. The equations and laws are clearly explained, and their range of application is indicated. The solutions and tests are outlined in detail, including the quantities of reagents and the steps in the preparation or analysis. The type compounds, radicals and reactions are given with structural formulas and equations. These definitions range in size from a few words to comprehensive articles, several pages long. This new dictionary is a valuable work tool for the chemist and engineer and a welcome addition to the technical bookshelf.

•

The Firestone Story. By Alfred Lief. Published by the McGraw-Hill Book Co., 330 West 42nd St., New York 36, N. Y. 6 x 9 in. 438 pp. $4.50.

Covering the first 50 years of the Firestone Tire & Rubber Co., this book gives not only a close-up of Harvey Firestone, Sr., but a glimpse into American history. It is a book about American inventiveness, industry and character, a story of the growth of a free competitive economy from its inception through 1950. Mr. Lief spent more than three years doing the research for the book, and during this time the archives of the Firestone organization were completely at his disposal. He also gathered much of his information from friends and employees of Mr. Firestone. Since the story of the Firestone organization lies in the reflected shadow of its founder, the book is biographical to a large extent, although Mr. Lief has also written a biography on Harvey Firestone with a sub-heading of "Free Man of Enterprise" (*Rubber Age*, November, 1951). This book takes its place along with the "House of Goodyear" as a factual report of the growth of one of America's foremost rubber manufacturing concerns.

•

Materials for Product Development: 1953. Published by Clapp & Poliak, Inc., 341 Madison Ave., New York 17, N. Y. 6 x 9 in. 265 pp. $7.50.

The eighteen papers presented at the Basic Materials Conference held in conjunction with the First Basic Materials Exposition in New York City in June, 1953, are reproduced in this book, along with the questions-and-answers which followed the presentation of some of the papers. The papers covered descriptions of the newest kinds of materials, such as radioactive materials, titanium and zirconium, to new applications of such staples as steel, ceramics and wood. Many materials were considered not only from the viewpoint of their usefulness in end-products, but also with reference to the manufacturing process. The papers in the book are divided into seven basic sections, including economics of engineering materials, high strength with low weight, high and low temperature service, atomic energy, electrical and electronic service, materials selection and specification, and coordination in selection of materials.

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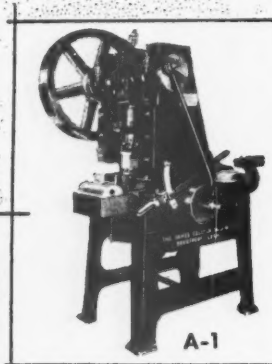

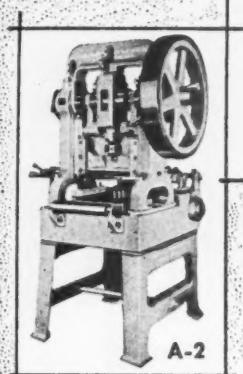

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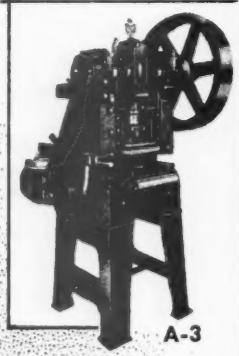

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Kautschuk-Fibel (Rubber Manual). By Dr. Stefan Reiner. Published by Berliner Union G.m.b.H., Stuttgart N, Germany. (In German). 5 x 7¼ in. 108 pp. DM 5.00 (approximately $1.25).

The latest edition of this pocket size manual is the third edition to be issued, the last one having been published about 10 years ago. It is subtitled "An Introduction to the Chemistry and Technology of Natural and Synthetic Rubber," and is intended to acquaint embryonic rubber chemists and engineers, as well as industrialists in general, with the chemical and physical properties of rubber. It is written in non-technical language and is divided into 16 subjects, such as history, latex, preparation of rubber, solvents, vulcanization, and applications. As an example, 20 pages are devoted to the manufacture of coated fabrics, 1 to the reclaiming of rubber, 4 to buna rubber, etc. The text portion of the manual occupies some 90 pages, and includes 24 illustrations and 2 tables. The data included covers the latest developments.

F. P.

•

Handbook of Probability and Statistics with Tables. By R. S. Burington and D. C. May, Jr. Published by Handbook Publishers, Inc., Sandusky, Ohio. 5¼ x 7¾ in. 340 pp. $4.50.

The applications of the theory of probability and statistics has enjoyed a rapid growth in many industrial fields. Intended as a convenient summary of theory, working rules and tabular material useful in practical problems in probability and statistics, this book brings together information which is not otherwise readily available in simple form except by reference to numerous journals, tables and treatises on the subject. It is divided into two main parts, the first including a summary of the more important formulas and definitions of elementary statistics and probability theory, and the second consisting of tables of distributions and other quantities of frequent use in statistical work. Because of the growing value of quality control in the rubber manufacturing field, the industry should find this book a helpful tool.

•

Toxic Solvents. By Ethel Browning. Published by Edward Arnold & Co., London, England. Available from St. Martin's Press, 103 Park Ave., New York 17, N. Y. 5½ x 8½ in. 168 pp. $4.00.

This book has been prepared as an active reference for industrial chemists, engineers, safety managers and all others concerned with safe and efficient plant operation. It includes a clear explanation of physical and chemical characteristics of organic solvents, a description of their physiological properties, a listing of all major solvents with their uses, properties, toxic effects and treatments, and a glossary of simple medical terms used. The book covers a number of solvents used in the rubber manufacturing industry, including benzene, toluene, xylene, cumene, carbon tetrachloride, the coal tar naphthas, dichloroethylene, and numerous alcohols and esters. Dr. Browning, the author, is medical inspector of factories for the British Government.

•

Statistical Design and Analysis of Experiments for Development Research. By D. S. Villars. Published by Wm. C. Brown Co., Dubuque, Iowa. 5½ x 8½ in. 456 pp. $6.50.

This book fills a long felt need in industry for a coherent exposition of the techniques of small-sample statistical analysis and at the same time elucidates a minimum of the fundamental basis of the underlying theory. The book is developed in what may be termed journalistic order, with methods of analysis being taken up first so that a worker can immediately make a start towards analyzing his own data. Suggestions are then advanced for designing an experiment with maximum efficiency. The finer points of statistical design are treated with in later chapters. The author, D. S. Villars, is no stranger to the rubber industry, having been associated with the U. S. Rubber Co. for many years, specializing in research on the physical chemistry of rubber latex.

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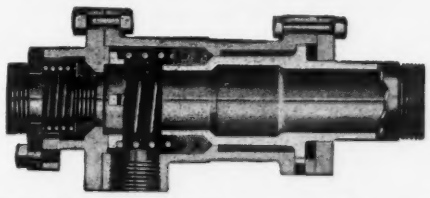

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BOOKLETS, CATALOGS, etc.

Natural Rubber Buying. Edited by W. J. Sears and C. C. Miller. Published by the Rubber Manufacturers Association, Inc., 444 Madison Ave., New York 22, N. Y. 6 x 9 in. 100 pp. $1.00.

This booklet was published as the result of a widespread demand within the rubber manufacturing industry for a printed record of the papers presented during the Crude Rubber Quality Seminars held during 1952 under the auspices of the Rubber Manufacturers Association. These seminars grew out of several years of intensive work by the RMA Crude Rubber Committee in its effort to raise the quality level of natural rubber imports by solving the serious raw materials cost and quality problems which had plagued the rubber industry since the end of World War II. They were held in rubber centers throughout the country and attracted audiences of large volume wherever held.

Papers reproduced in the handbook include those devoted to the methods, rules and terms of natural rubber purchasing; the history and purpose of RMA type samples and descriptions; the purpose of the RMA packing specifications; the purpose and techniques of natural rubber inspection, and the origin and preparation of various types of natural rubber. The questions and answers which formed a valuable portion of each seminar, all carefully edited, are presented in a special appendix, while other appendices are devoted to purchase and inspection standards, qualifications of the seminar panel, and an analysis of imports as to quality. A glossary of terms is also included. The handbook is an invaluable tool to all those charged with the responsibility of buying natural rubber.

•

Rolls for Industrial Use. (Catalog No. 48). Rodney Hunt Machine Co., Orange, Mass. 8½ x 11 in. 48 pp.

This is a completely revised edition of the company's complete catalog of its metal, rubber, wood and plastic rolls, the latter a fairly recent addition to the company's line. Illustrated and described in the catalog are solid wood rolls for wet and dry service, metal and wood guides, rolls and carrier rolls, wormed rolls for crease elimination, friction rolls, squeeze and press rolls, rubber-covered rolls, chromium-plated rolls, and stainless steel rolls. The catalog includes data on the simple but valuable routines by which wood or rubber rolls, properly cared for, can be made to deliver a greatly extended service life. An appendix consists of tear-out dimension sheets for use in supplying specifications on rolls, fulling-mill lags and textile machinery reels.

•

Synchronous Motor Control. (GEA-5873). General Electric Co., Schenectady 5, N. Y. 8½ x 11 in. 16 pp.

Synchronous Motors, their operation and control are described in this new two-color bulletin. The publication explains the electrical operation of synchronous motors and the areas where control is essential. Problems common to synchronous motor applications and their solution by using the correct control equipment are explained in a question-answer technique. The bulletin also describes various control units and gives rating and dimension data.

•

Quick-As-Wink Air and Hydraulic Control Valves. (Bulletin No. 531). C. B. Hunt & Son, Inc., Salem, Ohio. 8½ x 11 in. 12 pp.

This new bulletin describes and illustrates the company's line of air and hydraulic control valves, valve couplings, etc. The bulletin shows sectional views of the body, plunger, packing and interior operations of the various units. Also listed are sizes, actions, permissible pressures and temperatures and other data of interest.

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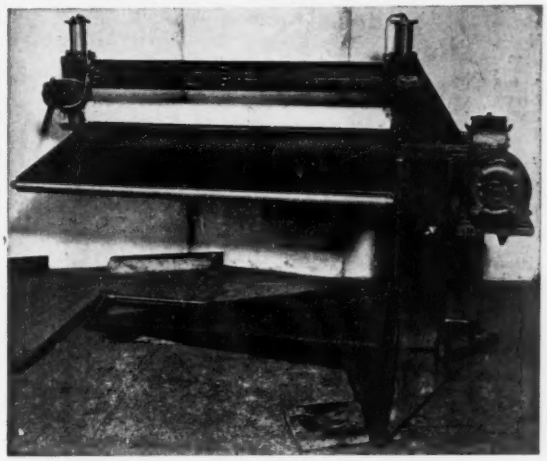

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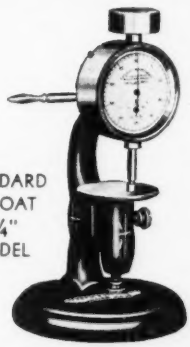

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MARKETS NEWS-PRICES

NEW YORK, JAN. 7, 1954

Raw Rubber

Natural: Since our last report (December 11), the average price of spot rubber on the New York Commodity Exchange has swung in a range of 50 points, high for the period being 20.88c reached on December 16, and low being 20.38c reached on December 16, 23 and 24. The average price of spot rubber for the month of December was 20.92c based on 22 trading days. This compares with an average of 20.58c in the previous month.

Hesitant markets continue both here and abroad. However, the trade advises that there is a distinct undercurrent of steadiness which stems from an underlying demand for natural rubber. Manufacturers were reported to be interested in taking on supplies at ⅛ to ¼c under the quoted market. At the same time, there have been rather liberal offerings at just a shade above that level. That rubber is for sale in fair volume is clearly illustrated by the increased shipment offerings. However, it has been some time since there was distinct evidence of a good consumer interest close to the market.

It is estimated in some quarters that world consumption of natural rubber in 1954 will parallel consumption in the previous year, with the United States consuming a little more and the rest of the world a little less. It is also estimated that production of natural rubber in 1954 will be slightly below that recorded in 1953. Consumption of new rubber was the greatest in history in 1953, and 1954 is expected to be only slightly less. At these levels, the picture for natural rubber looks fairly promising.

Synthetic: Production of synthetic rubber in 1954 is expected to be about 150,000 tons less than in 1953 on an overall picture. World consumption, too, will be running about 100,000 tons behind 1953, marking the expected reductions in the United States. A great deal, of course, depends on the price structure which will exist for synthetic rubber in the United States, and what political and economic measures seem expedient throughout the year.

Elsewhere in this issue there appears a report which states that a great deal of interest is being expressed by potential bidders for the synthetic rubber plants. The Rubber Producing Facilities Disposal Commission is reported to be happily surprised over this interest. Some 100 companies are reported to be in a position whereby they could handle one or more of the facilities being offered.

In the face of this interest, however, remains the fact that in this election year, some groups in Congress may find it politically profitable to attack prospective sales and thus impede the disposal program, if not kill it entirely. There are also reported to be some sections of the rubber industry which are opposed to disposal on still other grounds, and these objections may be more forcibly felt in the coming year.

Price Data

Closing Rubber Prices on New York Commodity Exchange (No. 1 R.S.S. Contract)

FROM DECEMBER 12 TO JANUARY 7

Dec.	Spot	Mar.	May	July	Sept.	Sales
12	——	——	——	——	——	——
13	——	——	——	——	——	——
14	20.38	20.21	20.30	20.30	20.30	60
15	20.62	20.40	20.45	20.65	20.65	21
16	20.88	20.75	20.80	20.80	20.85	13
17	20.50	20.40	20.35	20.35	20.40	6
18	20.50	20.35	20.40	20.40	20.45	29
19	——	——	——	——	——	——
20	——	——	——	——	——	——
21	20.25	20.15	20.25	20.25	20.25	7
22	20.50	20.50	20.60	20.50	20.50	10
23	20.38	20.28	20.25	20.25	20.25	4
24	20.38	20.25	20.25	20.25	20.30	2
25	——	——	——	——	——	——
26	——	——	——	——	——	——
27	——	——	——	——	——	——
28	20.62	20.50	20.55	20.55	20.55	2
29	20.62	20.50	20.45	20.50	20.50	31
30	20.62	20.50	20.50	20.50	20.50	14
31	20.62	20.50	20.50	20.50	20.50	24
Jan.						
1	——	——	——	——	——	——
2	——	——	——	——	——	——
3	——	——	——	——	——	——
4	20.50	20.30	20.35	20.35	20.35	1
5	20.38	20.25	20.25	20.25	20.25	19
6	20.62	20.50	20.50	20.55	20.55	15
7	20.62	20.59	20.59	20.59	20.59	23

Outside Market

No. 1 Ribbed Smoked Sheets:	
Spot	.20⅝
January	.20⅝
February	.20⅝
Thin Latex Crepe:	
Spot	.22¾
Thin Brown Crepe, No. 2	.17¾
Smoked Blankets	.17¼
Flat Bark Crepe	.15¼

London Market

(Standard Smoked Sheets)

March	20.21 - 20.35
Apr.-June	20.35 - 20.65

Singapore Market

(Standard Smoked Sheets)

January	18.89 - 18.96

Synthetic Rubber

(Dry Types—Per Pound)

Butaprene NF	.490 - .500
Butaprene NL	.500 - .510
Butaprene NAA	.540 - .550
Butaprene NXM	.580 - .590
Chemigum 30N4NS	.500 - .510
Chemigum 50N4NS	.500 - .510
Chemigum N3	.580 - .590
G-E Silicone Rubber (compounded)	3.15 -4.00
G-E Silicone Gum (not compounded)	—— -4.48
GR-I	—— - .220
GR-S	—— - .230
Hycar OR-15	.580 - .590
Hycar OR-25	.500 - .510
Hycar OS-10	.550 - .560
Neoprene Types AC and CG	—— - .550
Neoprene Type GN	—— - .410
Neoprene Type GN-A	—— - .410
Neoprene Type GRT	—— - .420
Neoprene Type KNR	—— - .750
Neoprene Type O	—— -1.00
Neoprene Type S	—— - .420
Neoprene Type W	—— - .410
Neoprene Type WRT	—— - .450
Paracril B	.500 - .510
Paracril BJ	.500 - .510
Paracril C	.580 - .590
Silastic (compounded)	2.35 -4.40
Thiokol Type A	—— - .470
Thiokol Type FA	—— - .640
Thiokol PR-1	—— - .950
Thiokol Type ST	—— -1.000

Middling Upland Quotations

	Dec. 11	January 7		
	Close	High	Low	Close
Mar.	32.95	33.38	33.27	33.27
May	33.10	33.63	33.52	33.52
July	32.98	33.54	33.38	33.41

Liquid Latex

Natural: Predicated upon figures available for consumption in 1953, it appears that the total figure for that year will be in the neighborhood of 70,000 long tons. This compares with the 42,834 long tons consumed in the previous year, and with the 53,567 long tons consumed in 1952. Recent price levels for nearby latex were at the 29-30c level. A great many complicating factors almost preclude a prediction of consumption in 1954, but it may be assumed that usage in the current year may approach 1953 levels.

Reports from abroad state that the main feature of the liquid latex market has been the failure of prices to follow small advances in the price of dry rubber. London believes, for example, that 1954 may still see periods of over-supply and poor returns. In general, however, an expanding market is foreseen, paralleling the growth which has been evident during the past few years.

Synthetic: It is believed that some 47,000 long tons of GR-S latex were consumed in 1953, about 7,000 more than in the previous year. 1953 will also show an approximate consumption of 8,000 long tons of neoprene latex against the 7,368 consumed in 1952. Consumption of acrylonitrile latices in 1953 is set at about 3,500 long tons, compared with the 3,093 long tons consumed in the previous year.

Synthetic latex consumption in the past few years has been rising steadily due, in no small part, to increasing demands for foam rubber products. If any one segment of the rubber industry is expected to show appreciable increases in the current year, the foam rubber market must be singled out as holding most promise. For that reason, it may be safely assumed that synthetic latex consumption in 1954 may be 15 to 20% higher than it was in 1953.

Cotton

The price of middling uplands on the New York Cotton Exchange has moved in a range of 75 points since our last report (December 11), high for the period being 33.95c reached on January 6, and low being 33.20c reached on December 16. The average price of middling uplands for the month of December was 33.52c based on 22 trading days. This compares with a price of 33.60c in the previous month. The average price of middling uplands cotton for 1953 was 33.81c, while in the previous year it was 39.71c.

The Senate Agriculture Committee has approved a bill increasing the 1954 national cotton allotment to 21,379,274 acres. The bill provides for a base of 21,000,000 acres, plus 315,000 acres as a national reserve. It also provides, in effect, that an individual farm allotment may be the higher of (1) 65% of the average planted to cotton in the past three years, or (2) 40% of the highest such area in any one of those years. No cotton allotment, however, could be higher than 50% of a farm's total cropland.

According to present indications, the United States may become an exporter of long staple cotton. Both trade and government officials have indicated that prices of some grades of long staple cotton were firming as the supply became tighter and that these prices might eventually approach the U. S. price support level. Almost all of this year's domestic production of about 65,000 bales is expected to end up in stocks of the Commodity Credit Corp.

MARKETS

NEWS-PRICES

NEW YORK, JAN. 7, 1954

Reclaimed Rubber

The Rubber Manufacturers Association estimates that approximately 284,000 long tons of reclaimed rubber were consumed in the United States in 1953. This places 1953 consumption only 4,000 tons ahead of consumption in the previous year. In 1953, the percentage of reclaim consumption to total new rubber consumption was 22.2%. On the basis of figures available for 1953 consumption, the percentage in 1953 will run in the order of 21.2%.

On an over-all picture, consumption of new rubber in 1954 is expected to run about 5% below 1953 figures. Applying this scale to reclaim, it would seem that some 270,000 long tons of reclaim will find use in the current year. Any substantial changes in the price of natural or synthetic rubber, however, could alter the picture insofar as reclaimed rubber is concerned. It may be said, however, that the industry expects to do about as much business in 1954 as it did in 1953.

(Prices for All Areas Except Calif.)

	per lb.
Premium Grade Whole Tire	.10½
First Line Whole Tire	.10
Second Line Whole Tire	.09½
Third Line Whole Tire	.09¼
Fourth Line Whole Tire	.08¾
Black Carcass	.14¼
No. 1 Light Colored Carcass	.20¾
No. 1 Select Peel	.11¾
No. 1 Peel	.10½
Butyl Tube Reclaim	.12½
S.P. Natural Rubber Black Tube	.16
Natural Rubber Black Tube	.15
Natural Rubber Red Tube	.24¼
Natural Rubber Gray Tube	.24¼

Tire Fabrics

The Department of Commerce, reporting on estimated production of cotton, rayon and nylon tire fabrics in the third quarter of 1953, states that 16,755,000 pounds of cotton fabrics were produced during the period, and 108,418,000 pounds of rayon and nylon fabrics. In the previous quarter, 21,593,000 pounds of cotton fabrics and 114,617,000 pounds of rayon and nylon fabrics were produced. In 1952, 135,950,000 pounds of cotton fabrics and 383,896,000 pounds of rayon and nylon fabrics were produced.

It will be seen from these figures, that in 1952 the ratio of rayon and nylon fabric production to cotton fabric production was about 3 to 1. Predicated upon the first three quarters of 1953, it would seem that the ratio for 1953 is in the vicinity of 5 to 1. If this trend continues, it appears likely, some trade sources believe, that the ratio in the coming year may be in the order of 7 to 1.

(Prices f.o.b. Shipping Point)

Rayon Tire Cord		
1100	lb.	.76½
1650	lb.	.73½
2200	lb.	.73
Nylon Tire Cord		
210	lb.	2.00
840	lb.	2.00
Rayon Graded Fabric		
1100	lb.	.72
1650	lb.	.69½
2200	lb.	.68½
Cotton Chafers		
14.4 oz. (per square yard)	lb.	.71
9.25 oz. (per square yard)	lb.	.66½
11.65 oz. (per square yard)	lb.	.63
8.9 oz. (per square yard)	lb.	.68

Scrap Rubber

Trade opinion indicates that from the standpoint of the dealer in scrap rubber, 1953 has not been a very satisfactory year. Prices moved within very narrow limits, with tires bringing about $13.50 per net ton for most of the year. Dealers note that this is the same price that was in effect prior to the outbreak of the Korean conflict in 1950.

Dealers also believe that in spite of the poor showing made by the scrap rubber market in 1953, 1954 holds promise of being a better year. One industry figure put it this way: "I think 1954 should be a good year . . . and scrap rubber, having already been down to the bottom, will start turning and move uphill toward more consumption and higher prices."

(Prices Delivered Akron)

Mixed tires	ton	13.50
Light colored carcass	lb.	.05
No. 1 peelings	ton	50.00
No. 2 peelings	ton	30.00
No. 3 peelings	ton	24.00
Buffings	ton	17.00
Truck and Bus S.A.G.	ton	16.00
Passenger S.A.G.	ton	15.00
Natural Rubber Red Tubes	lb.	.11
Natural Rubber Black Tubes	lb.	.04¾
Butyl Rubber Tubes	lb.	.02½

Rubber

Natural – Synthetic

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George Steinbach
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Cumberland 3-1400

STATISTICS *Of Interest to the Rubber Industry*

U. S. Imports and Re-Exports of Natural Rubber

	GROSS IMPORTS										RE-EXPORTS		TOTAL NET IMPORTS
	Natural Rubber (Dry)			Natural Rubber (Latex)			Guayule						
Year	Long Tons	Total Declared Value	Average Declared Value per pound Cents	Long Tons	Total Declared Value	Average Declared Value per pound Cents	Long Tons	Total Declared Value	Average Declared Value per pound Cents	Total Gross Imports Long Tons	Long Tons	Total Declared Value	Long Tons
1936	467,064	152,072,496	14.54	19,852	6,659,899	14.98	1,229	286,552	10.41	488,145	12,581	4,488,223	475,564
1937	574,600	237,307,041	18.44	23,185	10,213,670	19.67	2,691	745,873	12.37	600,476	7,948	3,386,408	592,528
1938	397,640	125,373,864	14.08	11,944	4,168,127	15.58	2,508	628,886	11.19	412,092	5,652	1,799,124	406,440
1939	469,946	167,586,780	15.92	27,437*	10,467,552	17.03	2,233	463,345	9.27	499,616	13,125	5,832,618	486,491
1940	781,202	303,308,823	17.33	33,789	14,593,466	19.28	3,633*	758,007	9.31	818,624	7,060	3,197,136	811,564
1941	989,498	401,976,317	18.14	34,797*	15,965,627	20.48	4,881	1,145,767	10.48	1,029,176	5,376	2,757,872	1,023,800
1942	266,276	112,537,426	18.87	10,646	5,630,667	23.61	5,523	1,660,792	13.42	282,445	10,856	5,913,386	271,589
1943	50,358	31,369,198	27.81	1,890	1,312,202	31.00	7,678*	3,636,789	21.14	59,926	22,583	16,446,707	37,343
1944	103,847	73,908,549	31.77	3,091	2,092,211	30.22	6,701*	3,351,233	22.33	113,639	9,739	8,712,695	103,900
1945	134,408	95,814,102	31.82	4,773	3,115,853	29.14	10,040	5,963,797	26.52	149,221	9,509	7,201,746	139,712
1946	376,502	228,796,110	27.13	8,421	5,843,085	30.98	5,344	2,859,246	23.89	390,267	7,711	5,331,954	382,556
1947	691,087	306,951,814	19.83	17,542	9,787,722	24.91	2,884	1,492,825	23.11	711,513	4,121	2,354,494	707,392
1948	702,293	290,849,177	18.49	32,745	18,288,223	24.93	302	71,330	10.53	735,340	6,672	3,259,324	728,668
1949	630,808	225,343,624	15.95	29,743	14,968,650	22.47	....	.....	....	660,551	6,253	2,746,109	654,298
1950	747,109	416,222,598	24.87	54,401	41,764,486	34.27	739	254,331	15.37	802,249	8,640	6,832,821	793,609
1951	677,874	727,343,348	47.90	54,963	80,178,309	65.12	1,619	1,258,941	34.71	734,456	2,603	3,947,740	731,853
1952	756,987	578,179,519	34.09	48,228	40,563,116	37.55	782	358,095	20.44	805,997	3,024	2,592,099	802,973
1952:													
Aug.	62,455	37,485,360	26.79	4,684	3,513,319	33.49	....	.....	....	67,139	373	278,927	66,766
Sept.	47,696	28,223,624	26.42	3,813	2,771,909	32.45	....	.....	....	51,509	279	202,978	51,230
Oct.	50,762	29,340,768	25.84	4,890	3,272,571	29.88	....	.....	....	55,652	337	248,642	55,315
Nov.	44,458	24,209,723	24.32	4,321	2,866,961	29.62	....	.....	....	48,779	585	414,704	48,194
Dec.	72,160	38,104,339	23.57	6,032	3,817,116	28.25	....	.....	....	78,192	615	417,656	77,577
1953:													
Jan.	57,516	31,296,490	24.29	6,250	4,168,234	29.77	....	.....	....	63,766	528	375,052	63,238
Feb.	42,562	24,336,087	25.80	6,338	4,480,115	31.55	....	.....	....	48,900	981	663,761	47,919
Mar.	50,115	28,724,364	25.59	6,671	4,733,320	31.68	....	.....	....	56,786	605	435,030	56,181
Apr.	54,272	29,729,394	24.45	6,302	4,206,828	29.80	....	.....	....	60,574	692	446,231	59,882
May	50,452	25,495,937	22.56	5,674	3,609,808	28.40	....	.....	....	56,126	521	334,048	55,605
June	55,020	26,430,694	21.45	6,407	3,786,254	26.40	....	.....	....	61,427	409	273,179	61,018
July	47,971	22,599,799	21.03	6,691	3,845,099	25.66	....	.....	....	54,662	596	370,533	54,066
Aug.	37,507	17,712,672	21.08	6,648	3,970,600	26.66	....	.....	....	44,155	567	348,745	43,588

Source: Bureau of the Census, U. S. Department of Commerce. * Adjusted to agree with total gross imports.

Notes: (1) Figures for latex are on a dry weight basis. (2) Figures for re-exports include natural rubber (dry and latex) and guayule. (3) In the years 1940 through 1943, crepe sole rubber imports were reported under separate classification. Such imports, which are included under natural rubber, dry above, were: 856,294 pounds, valued at $191,097 in 1940; 379,607 pounds, valued at $85,924 in 1941; 662,503 pounds, valued at $159,530 in 1942; and 21,653 pounds, valued at $5,215 in 1943.

Natural Rubber
(Including Latex and Guayule)

(All Quantities in Long Tons)

Year	New Supply	Consumption	Re-Exports	Stocks On Hand at End of Period
1937	600,479	543,600	7,902	262,204
1938	411,983	437,031	5,652	231,500
1939	499,473	592,000	13,125	125,800
1940	818,243	648,500	7,060	288,864
1941	1,029,007	775,000	5,376	533,344
1942	282,653	376,791	10,856	422,714
1943	55,329	317,634	20,815	139,594
1944	107,834	144,113	9,665	93,650
1945	135,672	105,429	6,743	118,715
1946	400,687	277,597	4,338	237,467
1947	688,354	562,661	4,101	129,038
1948	735,227	627,332	6,673	141,541
1949	660,792	574,522	6,253	106,619
1950	802,249	720,268	8,644	89,215
1951	733,048	454,015	2,603	76,569
1952	805,997	453,846	3,024	95,260
1952:				
Aug.	67,139	32,941	373	86,657
Sept.	52,785	45,110	279	84,150
Oct.	55,651	45,110	337	82,861
Nov.	48,777	41,749	585	86,243
Dec.	78,148	44,790	615	95,260
1953:				
Jan.	57,517	47,766	528	97,730
Feb.	48,455	45,231	981	94,151
Mar.	56,786	50,707	605	98,627
Apr.	60,578	49,375	692	108,892
May	56,280	46,889	521	113,532
June	61,423	45,224	409	112,959
July	54,661	43,929	596	118,825
Aug.	44,156	43,732	567	119,332
Sept.	58,625	45,225	790	121,618
Oct.	.....	46,480	679	113,888

Source: Rubber Division, NPA, U. S. Department of Commerce.

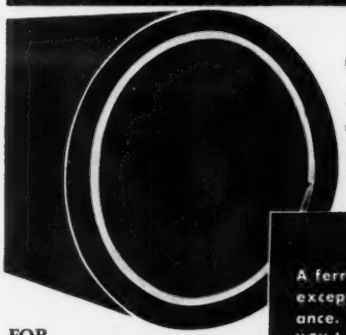
U.S. Gross Imports of Balata, Jelutong, Gutta-Percha, etc.

(All Quantities in Long Tons)

Year	Balata		Jelutong		Gutta-Percha & Other Guttas	
	Tons	Value	Tons	Value	Tons	Value
1936	535	199,368	6,163	1,296,364	1,568	535,643
1937	354	151,344	7,109	2,017,786	1,122	540,894
1938	509	181,140	9,132	2,944,504	444	204,582
1939	694	265,553	6,640	1,603,418	1,740	539,255
1940	648	300,500	7,451	2,449,137	2,340	1,004,885
1941	924	489,514	8,821	2,954,001	1,783	607,025
1942	1,544	1,107,059	1,200	530,296	804	525,763
1943	1,047	708,701	35	14,840	....	.....
1944	1,012	660,805	88	45,578	10	4,999
1945	1,361	907,253	....	.....	36	21,970
1946	2,281	2,233,065	304	256,169	423	458,064
1947	1,982	2,276,531	2,878	1,496,887	392	779,591
1948	1,195	805,078	3,401	2,377,765	423	542,788
1949	1,391	814,554	1,043	834,978	197	189,021
1950	2,117	1,589,885	1,789	1,515,162	541	745,418
1951	2,452	1,973,271	1,669	2,608,359	383	430,539
1952	988	762,994	1,636	2,094,983	282	385,890
1952:						
June	57	31,787	212	273,357	50	50,941
July	55	35,941	100	148,350	16	18,422
Aug.	16	9,037	142	193,364	28	31,011
Sept.	109	51,414	148	183,692	15	12,291
Oct.	130	125,137	95	99,181	20	17,937
Nov.	176	139,154	78	67,764	18	23,392
Dec.	132	145,270	101	87,548	14	25,878
1953:						
Jan.	....	.....	77	155,276	6	10,474
Feb.	105	67,265	120	182,792	21	32,473
Mar.	84	74,828	97	83,918	22	44,791
Apr.	309	196,917	87	76,143	7	7,761
May	53	27,463	552	64,822	5	3,388
June	106	56,457	90	93,063	16	16,565
July	160	79,349	66	59,003	40	48,868
Aug.	124	75,627	96	103,480	7	13,743

Source: U. S. Department of Commerce.

MEETING the PROBLEMS of the RUBBER- PLASTICS INDUSTRIES



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Synthetic Rubber—Totals

(GR-S, Neoprene, Butyl, and Buna N Types)

(All Quantities in Long Tons)

Year	Production	Imports	Consumption	Exports	Stocks On Hand at End of Period
1942	22,434	.....	17,651	1,419	4,612
1943	231,722	.....	170,891	18,148	41,568
1944	762,630	11,043	566,670	104,266	142,927
1945	820,373	10,407	693,580	83,778	203,454
1946	740,026	7,709	761,699	72,920	114,963
1947	508,702	1,093	559,566	11,385	62,366
1948	488,343	15,671	442,072	4,874	115,111
1949	393,690	17,242	414,381	6,483	98,042
1950	476,184	25,722	538,289	7,652	52,758
1951	845,159	10,085	758,897	9,249	129,912
1952	798,556	19,891	807,037	22,101	118,987
1953:					
June	80,227	919	71,751	1,769	143,789
July	79,360	991	61,299	1,910	159,486
Aug.	68,299	570	59,241	1,975	169,152
Sept.	60,677	1,068	58,652	2,223	167,625
Oct.	57,170	727	58,274	2,099	166,588

Source: U. S. Department of Commerce.
Notes: (1) These figures are revised from time to time and the latest available issue should be consulted for the most accurate data. (2) Figures shown include the output of both government and privately-owned plants. (3) Figures for 1941 are estimated.

Synthetic Rubber—By Type

(All Quantities in Long Tons)

New Supply

	GR-S (Buna S)	GR-M (Neoprene)	GR-I (Butyl)	Buna N Types	Total
1945	724,859	45,672	52,378	7,871	830,780
1946	613,408	47,766	80,823	5,738	747,735
1947	408,858	31,495	62,824	6,618	509,795
1948	405,492	34,848	56,662	7,012	504,014
1949	310,599	35,215	54,046	11,072	410,932
1950	378,887	50,067	60,915	12,037	501,906
1951	704,529	58,907	76,475	15,333	855,244
1952	654,854	65,745	81,630	16,228	818,447

Consumption

1945	600,145	42,394	43,012	8,029	693,580
1946	632,126	44,357	79,228	5,988	761,699
1947	448,589	37,703	68,838	4,536	559,666
1948	345,313	32,118	58,870	5,771	442,072
1949	299,420	31,753	50,855	8,827	414,381
1950	416,230	43,781	66,348	11,930	538,289
1951	626,444	48,887	70,500	13,066	758,897
1952	666,420	55,522	71,229	13,866	807,037

Exports

1945	76,555	5,837	980	406	83,778
1946	68,763	2,642	495	797	72,697
1947	7,951	2,617	62	755	11,385
1948	1,093	2,875	21	885	4,874
1949	1,401	3,330	178	1,574	6,483
1950	900	4,826	31	1,895	7,652
1951	483	6,825	216	1,725	9,249
1952	9,467	9,813	126	2,695	22,101

Stocks at End of Period

1945	170,571	9,703	18,378	4,802	203,454
1946	81,483	10,470	19,478	3,755	115,186
1947	40,606	5,237	13,184	3,339	62,366
1948	96,282	5,072	10,995	2,762	115,111
1949	77,731	4,654	12,224	3,433	98,042
1950	36,942	5,733	7,243	2,840	52,758
1951	105,271	8,379	12,481	3,821	129,912
1952	83,861	8,535	22,716	3,875	118,987

Source: U. S. Department of Commerce.
Notes: (1) These figures are revised from time to time and the latest available issue should be consulted for the most accurate data. (2) Figures for GR-M and Buna N Types include production of privately-owned plants.

Gasoline Consumption

(In Thousands of Barrels of 42 Gallons)

	1946	1947	1948	1949	1950	1951	1952	1953
Jan.	51,746	57,057	61,308	63,125	66,981	80,670	86,863	89,634
Feb.	47,654	50,551	56,487	57,980	53,274	72,864	82,043	86,458
Mar.	56,703	59,947	68,171	73,282	78,780	86,962	87,065	98,158
Apr.	62,111	64,140	72,183	75,318	80,350	87,573	98,653	102,044
May	66,800	70,865	77,186	81,665	89,035	100,266	101,137	105,867
June	63,247	71,329	78,044	83,374	90,174	96,364	99,305	105,918
July	60,076	73,441	81,428	83,129	91,677	100,567	105,307	114,703
Aug.	66,729	72,089	80,351	84,707	94,507	101,453	102,954	112,960
Sept.	62,268	71,384	76,159	80,832	86,725	91,891	100,095	109,124
Oct.	66,637	73,277	75,164	79,327	89,067	100,209	103,689	.....
Nov.	61,345	64,158	72,560	76,346	82,688	88,581	91,326	.....
Dec.	61,101	67,506	72,162	75,628	81,032	84,551	95,817	.....
Total	735,417	795,015	871,270	913,713	994,290	1,091,951	1,154,254	

Source: U. S. Bureau of Mines.

Reclaimed Rubber

(Including Natural and Synthetic)

(All Quantities in Long Tons)

Year	Production	Consumption Tons	Consumption % to Crude [a]	Exports	Stocks On Hand at End of Period
1937	185,033	162,000	29.8	13,233	28,800
1938	122,400	120,800	27.6	7,403	23,000
1939	186,000	170,000	28.7	12,611	25,250
1940	208,971	190,244	29.3	11,347	32,636
1941	274,202	251,231	32.2	13,851	41,750
1942	286,007 [b]	254,820	64.6	30,405	42,532
1943	304,058 [c]	291,082	59.6	15,678	46,201
1944	260,631 [d]	251,083	35.3	11,800	43,832
1945	243,309	241,036	30.2	13,413	28,155
1946	295,612	275,410	26.5	14,461	33,666
1947	291,395	288,395	24.8	14,556	35,943
1948	266,861	261,113	24.4	11,428	32,630
1949	224,029	226,679	22.5	10,637	28,263
1950	314,008	303,733	24.1	11,740	35,708
1951	366,700	346,121	28.6	14,722	45,082
1952	274,981	280,002	22.2	11,180	30,664
1953:					
Apr.	29,032	26,483	20.9	1,261	31,263
May	27,142	25,213	21.2	964	31,763
June	26,554	24,637	20.5	962	32,791
July	23,292	23,414	22.3	807	31,506
Aug.	22,607	22,666	22.0	638	30,318
Sept.	23,469	22,409	21.6	894	30,147
Oct.	23,504	21,781	20.8	866	30,876

Source: U. S. Department of Commerce.
Notes: (1) These figures are revised from time to time and the latest available issue should be consulted for the most accurate data. ([a]) Includes natural and synthetic rubber. ([b]) Includes 893 tons of imports. ([c]) Includes 67 tons of imports. ([d]) Includes 21 tons of imports.

Automobile Production in U. S.

(Civilian Production Only)

Year	Passenger Cars	Trucks	Total	Year	Passenger Cars	Trucks	Total
1933	1,573,512	346,545	1,920,057	1943	0	4,501	4,501
1934	2,177,919	575,192	2,753,111	1944	0	124,819	124,819
1935	3,252,244	694,690	3,946,934	1945	83,792	313,643	397,435
1936	3,669,528	781,862	4,451,390	1946	2,148,699	930,760	3,079,459
1937	3,915,889	892,382	4,808,271	1947	3,558,178	1,220,634	4,778,812
1938	2,000,985	485,852	2,486,837	1948	3,909,270	1,363,856	5,273,126
1939	2,866,796	704,308	3,571,104	1949	5,108,841	1,123,736	6,232,577
1940	3,692,328	721,637	4,413,965	1950	6,665,836	1,332,263	7,998,099
1941	3,744,500	875,381	4,619,681	1951	5,337,729	1,420,432	6,758,161
1942	220,814	133,083	353,897	1952	4,320,788	1,212,390	5,533,178
1952:							
Jan.	273,639	100,993	374,632	July	168,327	43,231	211,558
Feb.	334,058	100,533	434,591	Aug.	218,577	52,056	270,633
Mar.	373,237	109,167	482,404	Sept.	438,397	112,375	550,772
Apr.	416,155	112,833	528,988	Oct.	471,808	132,064	603,872
May	398,286	105,208	503,494	Nov.	405,111	114,106	519,217
June	408,700	109,526	518,226	Dec.	418,977	115,814	534,791
1953:							
Jan.	453,319	111,599	564,918	July	599,134	105,622	704,756
Feb.	486,071	96,740	582,811	Aug.	513,457	101,478	614,935
Mar.	566,320	134,129	700,449	Sept.	475,289	98,051	573,340
Apr.	596,633	126,788	723,421	Oct.	528,088	91,981	620,069
May	549,677	93,493	643,170	Nov.	.....	.....	.....
June	587,549	74,063	661,612	Dec.	.....	.....	.....

Source: Automobile Manufacturers Association.
Note: Figures are based on factory sales. Revisions are made from time to time in these figures and the latest issue should be consulted for accuracy.

Rim Production

	1948	1949	1950	1951	1952
Passenger Car	23,842,796	27,715,344	35,096,404	29,145,367	24,936,844
Truck & Bus	6,920,231	4,238,174	6,625,129	6,877,419	5,752,674
Agricultural	3,140,882	2,695,430	2,853,483	3,019,581	2,073,116
Earth Mover	13,330	9,895	15,602	28,026	31,791
Total	33,917,239	34,658,843	44,590,618	39,070,393	32,794,425

	1953 June	July	Aug.	Sept.	Oct.	Nov.
Passenger Car	3,087,588	2,882,348	2,425,096	2,151,010	2,286,669	1,886,944
Truck & Bus	342,900	380,636	399,013	342,106	304,713	322,822
Agricultural	196,957	138,098	121,468	128,262	94,063	72,135
Earth Mover	2,577	2,760	1,348	1,793	1,594	1,234
Total	3,360,022	3,403,842	2,946,925	2,623,171	2,687,039	2,283,135

Source: The Tire & Rim Association, Inc.

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Automotive Pneumatic Casings

(Thousands of Units)

	Shipments: Original Equipment	Shipments: Replacement	Shipments: Export	Shipments: Total	Production	Inventory End of Period
1942 (total)	**6,680**	**8,872**	**207**	**15,759**	**15,351**	**6,247**
Passenger Car.	910	2,734	38	3,682	2,790	4,432
Truck and Bus	5,770	6,138	169	12,077	12,561	1,815
1943 (total)	**6,128**	**18,547**	**225**	**24,900**	**20,423**	**1,883**
Passenger Car.	82	10,606	71	10,759	7,620	1,132
Truck and Bus	6,046	7,941	154	14,141	12,803	751
1944 (total)	**6,654**	**26,439**	**263**	**33,356**	**33,446**	**2,013**
Passenger Car.	208	18,330	130	18,668	18,819	1,218
Truck and Bus	6,446	8,109	133	14,688	14,627	795
1945 (total)	**5,984**	**36,479**	**504**	**42,967**	**44,524**	**3,077**
Passenger Car.	1,115	25,463	222	26,800	28,200	2,214
Truck and Bus	4,869	11,016	282	16,167	16,324	863
1946 (total)	**15,310**	**65,490**	**1,512**	**82,312**	**82,298**	**2,448**
Passenger Car.	11,086	54,684	653	66,423	66,466	1,763
Truck and Bus	4,224	10,806	859	15,889	15,832	685
1947 (total)	**25,056**	**62,871**	**3,256**	**91,183**	**95,550**	**6,949**
Passenger Car.	19,644	52,857	1,608	74,109	77,795	5,444
Truck and Bus	5,412	10,014	1,648	17,074	17,755	1,505
1948 (total)	**26,845**	**49,148**	**1,787**	**77,781**	**81,314**	**10,698**
Passenger Car.	21,589	41,295	656	63,540	66,738	8,773
Truck and Bus	5,256	7,853	1,132	14,241	14,576	1,925
1949 (total)	**31,584**	**43,466**	**1,467**	**76,517**	**76,369**	**10,638**
Passenger Car.	28,129	36,440	509	65,077	65,140	8,904
Truck and Bus	3,456	7,026	958	11,440	11,228	1,734
1950 (total)	**41,349**	**56,808**	**1,430**	**99,587**	**92,754**	**3,794**
Passenger Car.	36,678	47,103	642	84,423	78,598	3,050
Truck and Bus	4,671	9,705	788	15,164	14,156	743
1951 (total)	**32,153**	**44,612**	**1,677**	**78,442**	**83,405**	**8,765**
Passenger Car.	26,729	34,226	723	61,678	65,546	6,973
Truck and Bus	5,424	10,386	954	16,764	17,859	1,791
1952 (total)	29,484	54,342	1,520	85,346	90,411	14,110
Passenger Car.	24,106	45,458	741	70,305	74,341	11,251
Truck and Bus	5,378	8,884	779	15,041	16,070	2,859
1953:						
June (total)	3,537	5,601	142	9,279	8,572	16,259
Passenger Car.	3,216	4,819	75	8,111	7,311	12,852
Truck and Bus	320	782	66	1,168	1,261	3,406
July (total)	3,616	5,793	146	9,555	8,173	14,883
Passenger Car.	3,181	4,953	99	8,232	7,119	11,736
Truck and Bus	435	840	48	1,323	1,061	3,147
Aug. (total)	3,130	5,523	145	8,798	7,416	13,550
Passenger Car.	2,757	4,649	87	7,493	6,406	10,684
Truck and Bus	372	874	58	1,304	1,010	2,866
Sept. (total)	2,837	4,437	149	7,424	7,148	13,287
Passenger Car.	2,503	3,691	84	6,278	6,082	10,494
Truck and Bus	334	747	65	1,146	1,067	2,793
Oct. (total)	3,155	4,246	172	7,573	7,664	13,446
Passenger Car.	2,832	3,212	90	6,135	6,529	10,941
Truck and Bus	323	1,034	82	1,438	1,135	2,505

Source: The Rubber Manufacturers Association, Inc.

Cotton, Rayon and Nylon Tire Fabrics

(Production in Thousands of Pounds)

	Cotton: Tire Cord Not Woven	Cotton: Cord Fabric Woven	Cotton: Chafer and All Other Tire Fabrics	Cotton: Total	Rayon and Nylon[b]: Tire Cord Not Woven	Rayon and Nylon[b]: Tire Cord And Other Tire Fabrics	Rayon and Nylon[b]: Total
1950:							
Jan.-Mar.	**3,939**	**19,210**	**12,948**	**36,097**	**12,469**	**60,981**	**73,450**
Apr.-June	**11,077**	**29,498**	**14,071**	**54,646**	**11,510**	**59,966**	**71,476**
July-Sept.	**10,529**	**39,792**	**15,101**	**65,152**	**13,161**	**61,614**	**74,775**
Oct.-Dec.	**13,314**	**37,759**	**14,405**	**65,578**	**12,942**	**63,399**	**76,341**
Total	**38,859**	**126,259**	**56,525**	**221,473**	**50,082**	**245,960**	**296,476**
1951:							
Jan.-Mar.	11,497	38,269	16,737	66,503	11,878	65,512	77,390
Apr.-June	12,608	42,491	17,055	72,154	11,979	61,957	73,936
July-Sept.	16,744	44,340	17,433	78,517	12,091	67,982	80,073
Oct.-Dec.	14,237	43,820	13,899	71,956	*a*	83,354	83,354
Total	55,116	168,920	65,124	289,160	35,948	278,805	314,753
1952:							
Jan.-Mar.	11,226	36,378	12,971	60,575	14,434	72,249	86,683
Apr.-June	4,661	24,612	10,742	40,015	16,874	81,249	98,123
July-Sept.	335	9,257	9,460	19,052	18,128	80,355	98,483
Oct.-Dec.	*c*	4,728*a*	11,580	16,308	19,436	81,171	100,607
Total	16,222	74,975	44,753	135,950	68,872	315,024	383,896
1953:							
Jan.-Mar.	*c*	4,378*a*	15,477	19,855	20,487	91,742	112,229
Apr.-June	*c*	5,713*a*	15,880	21,593	18,906	95,711	114,617
July-Sept.	*c*	3,562*a*	13,193	16,755	18,597	89,821	108,418
Oct.-Dec.	.....	.....	.....	.....	.....	.....	.....
Total	.....	.....	.....	.....	.....	.....	.....

Source: U. S. Bureau of the Census.

Notes: (a) Included with tire cord and fabrics to avoid disclosures of operations of individual mills. (b) Fuel cell fabrics are not included with rayon and nylon tire cord and fabrics. (c) Included with tire cord not woven. (d) Included with chafer and all other tire fabrics.

Automotive Inner Tubes

(Thousands of Units)

	Shipments: Original Equipment	Shipments: Replacement	Shipments: Export	Shipments: Total	Production	Inventory End of Period
1944	6,460	20,569	196	27,224	27,488	2,813
1945	5,988	33,906	411	40,304	41,742	3,627
1946	15,327	59,357	1,424	76,108	77,251	3,820
1947	25,046	46,560	2,483	74,088	79,181	8,059
1948	26,833	40,548	1,119	68,499	70,033	9,641
1949	31,521	31,450	887	63,858	65,114	10,657
1950	**41,240**	**42,671**	**811**	**84,723**	**80,179**	.....
1951	**32,151**	**32,284**	**1,071**	**65,507**	**67,249**	**10,094**
1952	29,451	32,985	1,014	63,449	65,073	12,036
1953:						
June	3,539	3,298	71	6,907	7,035	12,811
July	3,614	3,600	73	7,288	6,395	12,097
Aug.	3,139	3,315	75	6,529	5,679	10,226
Sept.	2,841	2,768	111	5,720	5,656	11,288
Oct.	3,156	2,696	107	5,960	5,752	10,904

Source: The Rubber Manufacturers Association, Inc.

Smoked Sheets–Spot Closing Prices

(New York Market—Cents per Pound)

Year	High	Low	Avg.	Year	High	Low	Avg.
1912	140	108	121.60	1933	9⅞	2⅞	5.96
1913	113	59	82.04	1934	15⅞	8¾	12.92
1914	93	56	65.33	1935	13¾	10½	12.37
1915	79	58½	65.85	1936	23	13½	16.41
1916	102	55	72.50	1937	26⅞	14	19.39
1917	90	52	72.23	1938	17⅛	10¼	14.64
1918	70	40	60.15	1939	24	14⅛	17.57
1919	57	38½	48.70	1940	24	18¾	20.10
1920	56½	16	36.30	1941	24⅞	19¼	22.40
1921	21¼	11½	16.36	1942	22½	22½	22.50
1922	28¾	13¾	17.50	1943	22½	22½	22.50
1923	37⅛	24¾	29.45	1944	22½	22½	22.50
1924	40⅛	17¾	26.20	1945	22½	22½	22.50
1925	121	34¾	72.46	1946	22½	22½	22.50
1926	88½	36¾	48.50	1947	25	14	20.00
1927	41¾	33	37.72	1948	25	18	21.99
1928	41¼	17	22.48	1949	19¾	15⅞	17.57
1929	26⅞	15½	20.55	1950	86	18	41.10
1930	16½	7½	11.98	1951	76	52	(a)
1931	8⅝	4¾	6.17	1952*	33	26½	29.15
1932	4¾	2½	3.49	1953	31⅞	19⅞	24.21

Note: Price was fixed by Government on August 6, 1941, at 22½c a pound for non-war uses. Free trading was resumed May 1, 1947. (a) Free trading suspended March 31, 1951. GSA selling price ranged between 52 and 66c during balance of year. * Free trading was resumed on July 1, 1952; figures represent only July through December, 1952.

Spot Closing Cotton Prices

(Middling Upland Grade—New York Market—in Cents)

Average Monthly Price Per Pound

	1946	1947	1948	1949	1950	1951	1952	1953
Jan.	25.49	32.58	36.09	33.37	31.89	45.04	42.96	33.24
Feb.	26.57	33.91	33.63	33.41	32.79	(a)	41.64	33.76
Mar.	27.52	35.89	35.04	33.44	32.65	46.06	41.70	34.10
Apr.	28.40	35.89	38.10	33.84	33.23	46.06	41.79	33.85
May	28.17	36.51	38.57	33.73	33.64	46.06	39.68	34.30
June	29.89	37.83	38.12	33.56	34.61	46.06	41.31	34.11
July	34.11	38.03	34.89	32.99	38.11	41.21	40.37	34.20
Aug.	36.31	34.83	32.23	32.06	38.93	35.93	40.42	33.82
Sept.	37.59	32.21	31.92	30.94	41.62	36.20	39.75	33.69
Oct.	36.79	32.39	32.01	30.32	40.66	38.13	37.52	33.53
Nov.	31.50	34.50	32.15	30.52	43.11	42.70	35.59	33.60
Dec.	33.03	36.74	32.90	31.08	43.37	43.32	33.76	33.52
Average for Year	31.28	35.11	34.64	32.44	37.05	42.43	39.71	33.81

Note: The Government established a ceiling price of 45.76c for spot cotton on March 3, 1951. (a) Trading suspended during February.

Consumption of Vinyl Resins

(In Thousands of Pounds)

	Sheeting and Film[a]	Textile and Paper Coating Resins	Molding and Extrusion Materials	All Other
1950	227,149	46,044	113,889	21,868
1951	161,547	43,688	134,890	23,934
1952	154,902	42,298	140,872	31,793
1953:				
Feb.	16,516	4,145	13,847	2,919
Mar.	17,575	4,950	14,906	3,683
Apr.	16,574	4,934	15,332	2,800
May	14,766	4,126	13,509	3,084

Source: U. S. Tariff Commission.

Note: (a) Includes weight of fillers, plasticizers, extenders and safety glass sheeting. Beginning January, 1951, statistics are listed on a resin content basis.

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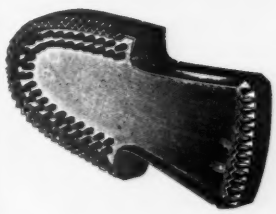

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Rubber Industry Employment, Earnings and Hours

All Rubber Products

Mo.	1952 Production Workers (thousands)	1952 Average Weekly Earnings	1952 Average Weekly Hours	1952 Average Hourly Earnings	1953 Production Workers (thousands)	1953 Average Weekly Earnings	1953 Average Weekly Hours	1953 Average Hourly Earnings
Jan.	210.4	$74.03	40.9	$1.81	219.2	$78.09	41.1	$1.90
Feb.	208.2	73.31	40.5	1.81	219.2	79.30	41.3	1.92
Mar.	208.0	72.54	40.3	1.80	220.5	80.29	41.6	1.93
Apr.	205.6	71.28	39.6	1.80	220.5	79.32	41.1	1.93
May	205.7	73.31	40.5	1.81	220.2	78.18	40.3	1.94
June	206.6	75.26	40.9	1.84	220.1	76.99	40.1	1.92
July	194.7	72.07	39.6	1.82	213.5	78.18	40.3	1.94
Aug.	203.1	73.49	40.6	1.81	215.5	....	....	....
Sept.	208.3	75.21	41.1	1.83	....	....	....	....
Oct.	212.5	75.53	41.5	1.82	....	....	....	....
Nov.	216.6	76.86	41.1	1.87	....	....	....	....
Dec.	219.2	79.19	41.9	1.89	....	....	....	....

Tires and Tubes

Jan.	91.3	87.12	40.9	2.13	91.5	89.24	40.2	2.22
Feb.	91.1	85.67	40.6	2.11	91.2	91.80	40.8	2.25
Mar.	90.8	83.58	39.8	2.10	91.6	93.83	41.7	2.25
Apr.	91.4	81.74	39.3	2.08	92.2	91.58	40.7	2.25
May	91.5	84.84	40.4	2.10	92.7	91.30	40.4	2.26
June	91.8	87.95	41.1	2.14	92.4	88.13	39.7	2.22
July	90.0	84.38	39.8	2.12	90.8	90.72	40.5	2.24
Aug.	88.6	85.46	40.5	2.11	....	....	....	....
Sept.	90.0	86.28	40.7	2.12	....	....	....	....
Oct.	90.2	85.88	40.7	2.11	....	....	....	....
Nov.	90.8	87.23	40.2	2.17	....	....	....	....
Dec.	91.8	90.42	41.1	2.20	....	....	....	....

Rubber Footwear

Jan.	24.1	60.15	40.1	1.50	24.5	64.96	40.1	1.62
Feb.	23.4	60.50	39.8	1.52	24.2	67.57	41.2	1.64
Mar.	22.9	61.51	40.2	1.53	24.2	67.57	41.2	1.64
Apr.	20.9	59.34	39.3	1.51	23.8	67.82	41.1	1.65
May	22.3	60.65	39.9	1.52	23.3	60.31	37.0	1.63
June	22.5	61.26	40.3	1.52	23.1	60.64	37.2	1.63
July	18.0	58.95	39.3	1.50	22.3	61.50	37.5	1.64
Aug.	22.7	61.81	40.4	1.53	....	....	....	....
Sept.	23.5	62.99	40.9	1.54	....	....	....	....
Oct.	24.3	63.71	41.1	1.55	....	....	....	....
Nov.	24.7	68.30	41.9	1.63	....	....	....	....
Dec.	25.2	66.49	41.3	1.61	....	....	....	....

All Other Rubber Products

Jan.	95.0	65.51	41.2	1.59	103.2	71.74	42.2	1.70
Feb.	93.7	64.55	40.6	1.59	103.8	71.06	41.8	1.70
Mar.	94.3	64.87	40.8	1.59	104.7	71.72	41.7	1.72
Apr.	93.3	63.84	39.9	1.60	104.5	71.21	41.4	1.72
May	91.9	65.28	40.8	1.60	104.2	70.93	41.0	1.73
June	92.3	65.85	40.9	1.61	104.6	70.93	41.0	1.73
July	86.7	62.25	39.4	1.58	100.4	70.82	40.7	1.74
Aug.	91.8	65.28	40.8	1.60	....	....	....	....
Sept.	94.8	67.65	41.5	1.63	....	....	....	....
Oct.	98.0	68.95	42.3	1.63	....	....	....	....
Nov.	101.1	69.81	41.8	1.67	....	....	....	....
Dec.	102.2	72.33	42.8	1.69	....	....	....	....

Source: U. S. Department of Labor.

Note: Data are based upon reports from cooperating establishments covering both full and part-time employees who work during, or received pay for, any part of the pay period ending nearest the 15th of the month. These employment series have been adjusted to first quarter 1951 benchmark levels indicated by data from government social insurance programs. Hours and earnings data pertain only to production and related workers.

Production Index for the Rubber Industry

Production 1935-1939 = 100

(Based on man-hours)

	1951	1952	1953		1951	1952	1953
Jan.	244	248	268	July	243	225	261
Feb.	235	243	270	Aug.	243	242	259
Mar.	239	242	275	Sept.	245	252	....
Apr.	238	235	272	Oct.	239	260	....
May	247	242	267	Nov.	245	264	....
June	251	246	266	Dec.	250	272	....

Source: U. S. Department of Commerce.

Sales by the Rubber Industry

(In Millions of Dollars)

	1951	1952	1953		1951	1952	1953
Jan.	454	468	507	July	438	408	511
Feb.	434	442	499	Aug.	467	452	515
Mar.	459	406	510	Sept.	435	482	....
Apr.	439	437	508	Oct.	445	464	....
May	432	424	472	Nov.	438	403	....
June	433	430	488	Dec.	363	438	....

Source: U. S. Department of Commerce.
Note: Figures have been revised to conform to new benchmark levels.

Rubber Manufacturers' Inventories

(Based upon Book-Value)

(In Millions of Dollars)

	1951	1952	1953		1951	1952	1953
Jan.	562	840	915	July	616	884	931
Feb.	555	848	887	Aug.	640	884	914
Mar.	554	865	903	Sept.	659	877	....
Apr.	565	877	916	Oct.	705	874	....
May	583	878	924	Nov.	739	897	....
June	610	864	942	Dec.	799	936	....

Source: U. S. Department of Commerce.

Various Compounding Materials Consumed by the Rubber Industry

Material	1946	1947	1948	1949	1950	1951	1952
Antimony, Primary:							
Short tons	.....	39	41	55	103 [c]	19 [c]	66
% of total	.....	.002	.003	.005	.007	.001	.005
Asphalt: [a]							
Short tons	28,715	32,113	19,967	18,050	26,819	21,414	33,288
% of total	0.7	0.7	0.4	0.3	0.3	0.3	0.4
Barite (Barytes):							
Short tons	20,000	17,000	18,000	14,000	19,000	15,000	14,000
% of total	4.4	3.1	2.85	2.53	3.31	2.13	2.0
Carbon Black:							
Short tons	470,732	471,790	435,282	383,565	515,184	530,614	537,273
% of total	95.3	94.3	95.5	93.3	92.9	93.9	93.1
Clay, Kaolin:							
Short tons	162,393	166,201	176,965	197,341	263,306	231,331	240,982
% of total	12.3	11.5	11.3	13.1	15.0	12.7	13.2
Clay, Fire & Stoneware:							
Short tons	12,951	17,970	15,480	27,148	9,500	.....	9,322
% of total	0.2	0.2	0.2	0.3	0.1	..	0.1
Lime:							
Short tons	3,193	589	1,154	715	908	1,126	2,000
% of total	0.05	0.01	0.02	.0002	.0002	[d]	[d]
Litharge:							
Short tons	2,131	2,205	2,835	1,398	3,047	2,641	2,109
% of total	1 6	1.3	1.8	1.2	1.7	1.7	1.5
Lithopone:							
Short tons	1,607	3,085	4,192	3,245	4,092	3,295	1,523
% of total	1.1	1.9	3.0	4.1	3.9	3.2	2.5
Mica, Ground:							
Short tons	4,951	3,900	4,372	3,856	5,776	6,551	5,126
% of total	8.0	6.0	7.0	7.0	8.0	9.0	7.0
Sulfur:							
Short tons	72,800	72,800	70,560	59,360	75,000	75,000	75,000
% of total	2.2	1.8	1.7	1.5	1.3	1.6	1.6
Talc: [b]							
Short tons	65,980	71,840	66,226	53,400	75,900	70,970	64,476
% of total	14.4	13.9	13.0	12.0	12.0	11.2	10.9
Zinc Oxide:							
Short tons	83,776	82,248	82,895	58,496	82,944	71,507	72,774
% of total	53.1	51.2	54.9	52.5	51.6	48.4	51.2

Source: U. S. Bureau of Mines.
Notes: [a] Solid and semi-solid products of less than 200 penetration. [b] Includes prophyllite and ground soapstone. [c] Does not include precipitated antimony sulfide as in previous years. [d] Negligible.

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PLANT MANAGER OR SUPERINTENDENT wishes to locate with progressive firm. Extensive experience in mechanical rubber goods operations, covering production, product development, laboratory research, quality control, etc. Capable of assuming complete charge or taking supervisory position. Age 41. Married. Excellent references. Address Box 822-P, RUBBER AGE.

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Experienced in small business management, sales and broad technical work. Specialized in large and small plant product development, production problems, etc., primarily rubber field. Age 39. Prefer warm climate, foreign considered. Address Box 820-P, RUBBER AGE.

SUPERINTENDENT OF PRODUCTION, desires new connections. Capable as Technical Director or Production Manager for mechanical rubber goods and sponge rubber products. My knowledge of the industry is practical and technical. University educated. Address Box 840-P, RUBBER AGE.

CHEMICAL ENGINEER-RUBBER TECHNOLOGIST with 15 years experience in plant management, research and development, new products, technical service, compounding, equipment and process design, production and quality control. Expert knowledge of latex compounds and processes, plastisols and organisols, and rubber products in general. Excellent record of achievements. Desires challenging position of responsibility. Will relocate. Address Box 842-P, RUBBER AGE.

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CHEMICAL ENGINEER. We need a Chemical Engineer, 25 to 35 years old, with experience in compounding, testing and manufacturing of mechanical molded products and, if possible, compounding of rubber sealers and adhesives. Excellent opportunity to work closely with Chief Engineer in expanding research, development and quality control program of small, progressive manufacturer in Northeastern Ohio. Good salary. Pension and vacation plans. Other benefits. Please send resume and salary expected. Address Box 830-W, RUBBER AGE.

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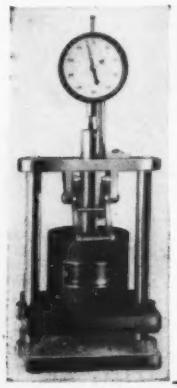

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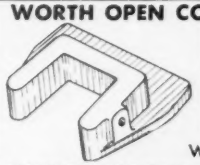

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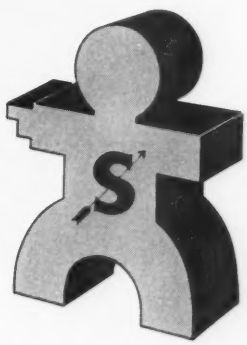

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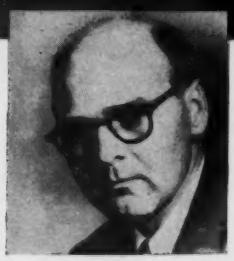

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